INTERIM RECORD OF DECISION

RESIDENTIAL PROPERTY SURFACE SOIL (part of operable unit 3)
at

MADISON COUNTY MINES SUPERFUND SITE

in

MADISON COUNTY, MISSOURI

Prepared by:

U. S. Environmental Protection Agency
Region 7
901 North 5th Street
Kansas City, Kansas 66101

July 2008

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Residential Properties, Part of Operable Unit #03 (OU-3)
Madison County Mines Superfund Site
Madison County, Missouri
CERCLIS ID #: MOD098633415

STATEMENT OF BASIS AND PURPOSE

This interim decision document for OU-3 presents the selected remedial action for lead-contaminated residential property soil at the Madison County Mines Superfund Site. This decision was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act, as amended by the Superfund Amendments and Reauthorization Act, and, to the extent practicable, the National Contingency Plan. This decision is based on the Administrative Record for the site. The Administrative Record is located at the following information repositories:

Ozark Regional Library – Fredericktown Branch
115 South Main Street
Fredericktown, Missouri 63645

U.S. Environmental Protection Agency
Region 7
901 North 5th Street
Kansas City, Kansas 66101

The state of Missouri concurs with the Selected Remedy. State comments are presented and addressed in the attached Responsiveness Summary.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response actions selected in this Interim Record of Decision (ROD), present a current threat to public health, welfare, or the environment. Therefore, the response action selected in this Interim ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. The Site contains heavy metals, in particular lead, in soil as a result of historical lead mining and processing.

DESCRIPTION OF THE SELECTED REMEDY

The U.S. Environmental Protection Agency (EPA) believes the Selected Remedy (Alternative 2 with an estimated present worth cost of approximately $22.4 million) appropriately addresses the principal current and potential risks to human health and the environment. The remedy addresses human health risks by the remediation of lead-contaminated residential property soil.

The residential properties at the Site are being addressed by this Interim ROD to expedite cleanup of the areas that pose the greatest and most immediate threats to human health. The major components of the selected remedy for the residential properties across Madison County include the following actions:

- Excavation, backfilling, and revegetation of lead-contaminated residential soil exceeding 400 parts per million lead at an estimated 1,100 residential properties;

- Health education for Madison County to support and raise public awareness, conduct community-wide blood-lead monitoring, distribute prevention information, hold meetings with and act as a resource for area physicians of local families, and undertake special projects to increase awareness of how local citizens can protect themselves from heavy metal health risks; and

- Institutional controls pilot project. This includes collaboration with interested citizens and local, county, state, and federal government officials on an institutional controls pilot project to discuss and evaluate future institutional controls to safeguard future residential development and protect remediated residential properties.

STATUTORY DETERMINATIONS

The Selected Remedy is protective of human health and the environment, complies with federal and state laws that are legally applicable or relevant and appropriate requirements for the remedial action, and is cost effective. The remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable but does not use treatment as a principal element because of the lack of demonstrated, effective treatment alternatives. Because the Selected Remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

Cecilia Tapia, Director for
Superfund Division
U.S. EPA, Region 7

7/31/08
Date

Interim Record of Decision
Residential Property Surface Soil
Madison County Mines Superfund Site
Operable Unit 3
Madison County, Missouri

SITE NAME, LOCATION, AND DESCRIPTION

This Interim Record of Decision (ROD) for the Madison County Mines Site (Site), Operable Unit 3 (OU-3), concerns upcoming remedial actions to address lead surface soil contamination at residential yards and public areas across Madison County. It provides background information, summarizes recent information driving the Selected Remedy, identifies the Selected Remedy for cleanup and its rationale, and summarizes public review and comment on the Selected Remedy.

This Interim ROD is a document that the U.S. Environmental Protection Agency (EPA), as lead agency for the Site, is required to issue to fulfill the statutory and regulatory requirements found, respectively, in Section 117(a), of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 U.S.C. § 9617, as amended, and in the National Contingency Plan (NCP), 40 C.F.R. § 300.430(f)(4). The support agency is the Missouri Department of Natural Resources (MDNR). EPA plans to conduct the remedial action as federal fund-lead work.

The Site covers Madison County, Missouri, and as a mining site, includes any media impacted by heavy metals mainly related to historical mining and milling activities. The Site is located in Madison County, approximately 80 miles south of St. Louis, in southeastern Missouri at the southern end of the Old Lead Belt, where heavy metal mining occurred since the early 1700s and industrial mining since the 1800s. The Site consists of all areas within Madison County that have been impacted by past mining practices and the migration of the resulting mine waste. The Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) identity number is MOD098633415. A citizen can use the CERCLIS number on EPA's web site to get information on the Site. A glossary of common Superfund terms is included at the end of this document.

This Interim ROD highlights key information from the Remedial Investigation (RI), Baseline Human Health Risk Assessment (HHRA), Focused Feasibility Study (FS), and Proposed Plan recently released for the Site for part of OU-3. These and other documents are available for additional information regarding the upcoming remedial action in the Site Administrative Record (AR) located at the local Ozark Regional Library or EPA Regional Office in Kansas City, Kansas, at the addresses listed below:

Ozark Regional Library - Fredericktown Branch
115 South Main Street
Fredericktown, Missouri 63645
Hours: Monday, Wednesday – Friday (10:00 a.m. – 5:30 p.m.)
Tuesday (10:00 a.m. – 8:00 p.m.)
Saturday (10:00 a.m. – 3:00 p.m.)

or

U.S. Environmental Protection Agency, Region 7
Records Center
901 North 5th Street
Kansas City, Kansas 66101
Hours: Monday – Friday (8:00 a.m. - 5:00 p.m.)

SITE HISTORY AND ENFORCEMENT ACTIVITIES

Activities leading to current problems: Lead ore was discovered in the area of Mine La Motte (north of Fredericktown) by French explorers around 1715. The area was already known to and likely was being exploited by local natives. Mining commenced in the early 1720s and continued intermittently on a comparatively small scale through the 18th century. Mining and beneficiation activities increased significantly at Mine La Motte and what is now known as the Madison Mine beginning in the mid-1840s and expanded throughout Madison County in the period following the Civil War. Most of the smaller mines located around the county were operated at that time. Mining in Madison County has produced copper, lead, cobalt, nickel, iron, and small amounts of zinc, silver, and tungsten.

Past mining operations have left at least 13 identified major areas of mine waste in the form of tailings and chat deposits from significant mineral processing operations and smelting in Madison County (Figure 1). Chat deposits include sand- to gravel-sized material resulting from the crushing, grinding, and dry separation of the ore material. Tailings deposits include sand- and silt-sized material resulting from the wet washing or flotation separation of the ore material. The mine waste contains elevated levels of lead and other heavy metals which pose a threat to human health and the environment. These deposits may have contaminated soil, sediments, surface water, and groundwater. These materials also may have been transported by wind and water erosion or manually relocated to other areas throughout the county. It has been reported that mine waste may have been used on residential properties for fill material and private driveways, used as aggregate for road construction, and placed on public roads around Fredericktown to control snow and ice in the winter.

Federal, state, and local site investigations, and removal or remedial actions: Starting in 1980, a number of investigations by various organizations were conducted on the county's mine waste and its effects, most of which focused on the areas affected by mine waste within OU-2 (Anschutz subsite.) See Figure 1 for a site map of the mine waste areas within the Site. In order to investigate a broader area, EPA performed an Expanded Site Inspection (ESI) on the Little St. Francis River (LSFR) watershed at the Site in 1995. The ESI attempted to identify potential sources of mine waste in the LSFR watershed, determine the composition of these sources, and determine if there had been a release of mining-related contaminants (heavy metals) to media within the LSFR watershed. Geographically, the ESI included OU-1 (Northern Madison County Unit), OU-2, and the Skaggs, Catherine, and Conrad mine waste areas. A limited number of samples were collected from mine waste, groundwater, sediment, and soil and were analyzed for heavy metals. The results indicated elevated concentrations of a number of heavy metals. Additionally, studies conducted by the Missouri Department of Health and Senior Services (MDHSS) and the Madison County Health Department concluded that some children in Madison County had elevated levels of lead in their blood.

As a result of the elevated blood lead levels in children, the presence of mine waste piles in Madison County, and previous investigations, EPA began conducting removal assessment activities at the Site, focusing on lead-contaminated surface soil in residential yards and other public areas frequented by children. The removal assessment consisted of obtaining access to residential yards or public areas, documenting current property conditions, collecting surface soil throughout the property, and analyzing the samples for metals with a portable X-Ray Fluorescence (XRF) instrument. EPA started assessing lead-contaminated soil in the Harmony Lake area in 2000 and shifted the assessment to Fredericktown starting in 2002. At that time, EPA expanded its lead-contaminated soil assessment to cover residential properties within the county and stopped in 2006. To date, approximately 3,100 residential properties have had their soil sampled and analyzed for metals.

Because assessment results in the Harmony Lake area indicated children's health was at risk due to lead levels in residential surface soil, an Action Memorandum was signed by EPA on September 8, 2000, outlining the rationale for implementing a removal action in the Harmony Lake area. The removal action consisted of excavating the soil in areas with elevated lead concentrations up to one foot below ground surface (bgs) and two feet bgs in garden areas and replacing it with clean soil. Additionally, the approximately 30-acre Harmony Lake tailings pile was covered with one foot of soil to stabilize the mine waste and minimize its impact on human health and the environment.

In 2002, at the request of the Madison County Health Department, EPA tested mine waste recently brought in to be used as fill at a farm supply company in Fredericktown. Upon confirming elevated concentrations of metals, particularly lead, in the mine waste fill at the property and upon confirming at least one child living nearby with an elevated blood lead level (greater than 10 micrograms per deciliter [μg/dL]), EPA signed two Action Memoranda authorizing two removal actions. The first removal action, conducted by the farm supply company under a Unilateral Administrative Order, included removing all mine waste and contaminated soil with lead concentrations greater than 400 parts per million (ppm) from the farm supply property and redepositing it at its original location, currently called the LSFR subsite. In some locations on the property, clean fill material was brought in to raise the grade.

A second Action Memorandum was signed in September 2002 to minimize human exposure to lead-contaminated soil in sensitive population areas (such as daycare centers, public parks, other public recreational facilities, and homes with potentially lead-impacted children) in the Fredericktown area. Similar to the Harmony Lake removal action, the Fredericktown removal action (started in 2003) consisted of excavating the soil in areas with elevated lead concentrations up to one foot bgs and two feet bgs in garden areas and replacing it with clean soil. In 2004, another removal action very similar to the Fredericktown removal was initiated to address a number of residential properties within OU-1 in the northern part of Madison County. When both removal actions were finished in October 2006, hundreds of residential properties, which included daycare centers, schools, churches, and trailer parks, had been remediated. During these removal actions, approximately 128,594 cubic yards (yd^3) of lead-contaminated soil were transported from the residential properties to the repository at the Catherine Mine subsite for placement on top of the mine waste.

As part of the removal assessment, EPA also collected and analyzed a limited number of surface water and sediment samples across the Site. The results of this sampling as well as the ongoing residential property surface soil sampling indicated various heavy metals at concentrations greater than their respective background concentrations. Additionally, surface water samples contained iron, lead, nickel, aluminum, copper, and silver concentrations which exceeded the MDNR aquatic life standards. As a result of the elevated levels of heavy metals present, the Site was placed on the National Priorities List on September 29, 2003. The RI report and Focused FS report for the residential property part of OU-3 was issued on April 2008. Both the RI and Focused FS are in the AR.

COMMUNITY PARTICIPATION

Since 1999, the Madison County Environmental Roundtable (an active group of concerned citizens and government officials) has been meeting to discuss contaminated residential property soil and other environmental issues. These bi-monthly meetings have included representatives from EPA, MDNR, MDHSS, U. S. Agency for Toxic Substances and Disease Registry (ATSDR), Madison County Health Department, elected officials of both Madison County and Fredericktown, news media, visiting academics and students, and local citizens.

The public was encouraged to participate in the Proposed Plan and Interim ROD process for the lead-contaminated residential surface soil at the Site. The Proposed Plan highlighted key information from the RI Report, Focused FS Report, HHRA, and other supporting documents in the AR. Additionally, the public historically has been made aware of the environmental issues in the county through fact sheets, public availability sessions, and press releases during the previous removal cleanups that have occurred at the Site. In order to provide the community with an opportunity to submit written or oral comments on the Proposed Plan for the residential soil, EPA established a 30-day public comment period from April 16 to May 15, 2008. The notice of availability of the AR file and the Proposed Plan was published in the local newspaper, the Democrat News, on April 16, 2008. A public meeting was held on April 29, 2008, at 6:30 p.m. at the Black River Electric Cooperative in Fredericktown, Missouri, to present the Proposed Plan, accept written and oral comments, and answer any questions concerning the proposed cleanup. EPA also used the public meeting to talk about a future institutional controls (ICs) pilot project that is included in the Interim ROD, and will evaluated along with other IC alternatives for possible selection in a final ROD for OU-3. Thirteen local officials and citizens attended the public meeting. A summary of the verbal questions received at the public meeting and the responses is provided in the attached Responsiveness Summary. The Responsiveness Summary also contains a summary of written correspondence received during the public comment period and EPA's written responses to public comments.

SCOPE AND ROLE OF THE RESPONSE ACTION

The Interim ROD for OU-3 addresses surface soil in residential properties in Madison County. The Site has been divided into six OUs to organize the work into logical elements based on similar contaminated media, geographic and demographic features of the Site, and setting priorities for the work. The final decisions on cleanups for the other OUs will be issued in the future as RODs under remedial authority. The six OUs are described in detail as follows:

- OU-1 is located in northern Madison County and consists of the Mine La Motte Recreation Association (MLMRA) subsite that contains approximately 250 acres of tailings; the Slime Pond (a 100-acre lake that adjoins the MLMRA); the Harmony Lake area; the Copper Mines mine waste; the Old Jack Mine; the Lindsey Mine; the Offset Mine, the small gage feeder rail right-of-way to the abandoned Black Mountain spur; and all other areas affected by these mining activities.

- OU-2 consists of the area adjoining and just southeast of the city of Fredericktown, Missouri, and includes the A, B, C, D, and E Tailings Areas (historically called the Madison Mine); the metallurgical pond; remnants of an old mill and smelter; headframe and abandoned shafts; a mine decline; a refinery complex; a chat pile; the abandoned Black Mountain spur right-of-way through Fredericktown; and all other areas affected by these mining activities.

- OU-3 includes all residential properties including public areas in Madison County as well as the entire cities of Fredericktown, Junction City, and Cobalt Village, and the LSFR subsite. Within and around the cities and the LSFR area, OU-3 also includes all streets, road right-of-ways, public drainage ways, possible smelter stack and mine waste pile wind-blown contamination, groundwater, surface water and sediments in Goose Creek and Tollar Branch, and mine works locations and outflows.

- OU-4 includes the entire Conrad subsite with its mine waste as well as the adjoining Ruth mine and mill complex, surface water and sediments affected by the mine waste, eroded materials to the LSFR from the Conrad subsite, road right-of-ways and public drainage ways, possible smelter stack and mine waste pile wind-blown contamination, groundwater impacts, and mine works locations and outflows.

- OU-5 includes the Catherine Mine with its mine waste, pond, and repository; the Skaggs mine waste; and any areas affected by the overhead tram from the Catherine Mine to the LSFR subsite. OU-5 also includes surface water, sediments, road right-of-ways, public drainage ways, and groundwater affected by the Catherine or Skaggs mine waste as well as nearby mine works locations and outflows.

- OU-6 includes all other known and undiscovered mining-related contaminated areas including but not limited to the Silver Mines area, nearby groundwater, surface waters and sediments in the unnamed runoffs to the LSFR, road right-of-ways, public drainage ways, and mine works locations and outflows.

The Selected Remedy represents EPA's interim approach to address a portion of OU-3 that includes residential properties at the Site. This portion of OU-3 includes lead-contaminated surface soil present at residential properties across Madison County that have been contaminated as a result of migration of metal-bearing materials from past mining practices via natural erosional processes and human activities. For the purposes of this document, the term residential properties includes properties that contain single- and multi-family dwellings, apartment complexes, vacant lots in residential areas, schools, daycare centers, playgrounds, parks, and green ways. Under the Selected Remedy, the residential properties are being addressed first to expedite cleanup of the areas that pose the greatest and most immediate threats to human health.

The Selected Remedy represents the first remedial action for the Site and is a continuation of the residential soil cleanup actions that periodically have been going on in Madison County since 2001 as removal actions. The remaining actions for OU-3 and the other OUs will be addressed by future RODs since there is less overall human health risk associated with them.

The Interim ROD for OU-3 addresses surface soil in residential properties in Madison County. Under any remedial strategy, a number of years will be required to investigate and evaluate remedial alternatives for both the residential property and mine waste pile components of OU-3. Therefore, this Interim ROD describes the interim approach selected by EPA to address the highest priority at the Site—human health risk posed by residential property soil—while additional evaluations are performed at OU-3. The Selected Remedy in the Interim ROD will be consistent with the final remedial action selected for OU-3 in the final ROD, which will include the LSFR subsite. The current goal is to complete the cleanup work at the Site by 2020. The last mine waste cleanup action will address OU-6, the Silver Mines subsite.

SITE CHARACTERISTICS

Geographical and topographical information: The Site covers all of Madison County, Missouri, which is approximately 498 square miles. Madison County is subdivided into the St. Francois Mountains on the western side of the county and the Salem Plateau on the eastern side of the county. Topographically, the St. Francois Mountains comprise a geologically mature landscape with rounded ridges and meandering streams that occupy comparatively wide valleys. In a few locations, rivers and streams cut across ridges, forming steep canyons.

Much of the Site is underlain by Paleozoic (Cambrian) sedimentary rocks that rest on Precambrian crystalline rocks or basement complex which form the St. Francois Mountains. The sedimentary formations vary in thickness and locally thin out or pinch out against structural highs of the basement complex (St. Francois Mountains). The rock formations present in the area include the following, from the Precambrian basement up: (1) the Lamotte Sandstone, (2) the Bonneterre Dolomite, (3) the Davis Formation, and (4) the Derby-Doe Run Dolomite. Soil formed from these formations is predominantly clays with comparatively low permeabilities. Soil profiles and horizons are generally well developed.

Most lead mineralization in the Madison County area occurs within the lower part of the Bonneterre Dolomite on the flanks of buried or exposed Precambrian topographic highs, generally within a few hundred feet of the boundary where the underlying Lamotte Sandstone pinches out. Lead ore, primarily in the mineral galena, and other metallic minerals occur as deposits that have replaced dolomite crystals in portions of the Bonneterre Dolomite. The ore occurs in horizontal sheets along bedding planes, cavity fillings, and linings on the walls of joints and fractures. The deposits extend laterally for hundreds of feet and may extend 200 feet vertically. However, mineralization in the Silver Mines area is distinct, consisting of quartz veins in the Precambrian basement complex that contain galena, wolframite (iron tungstate), and additional sulfide minerals as primary ore phases for additional metals such as tungsten and silver.

Type and sources of contamination: As indicated previously, past mining operations have left at least 13 identified major mine waste areas in the form of tailings and chat deposits from smelting and mineral processing operations in Madison County. The mine waste contains elevated levels of lead and other heavy metals which pose a threat to human health and the environment. These deposits, acting as a source, have contaminated soil, sediments, surface water, and groundwater. These materials may also have been transported by wind and water erosion or manually relocated to other areas throughout the county. It has been reported that mine waste may have been used on residential properties for fill material and private driveways, used as aggregate for road construction, and placed on public roads around Fredericktown to control snow and ice in the winter.

A conceptual site model (CSM) for human exposure pathways to heavy metals resulting from mine waste at the Site is included as Figure 2. It should be noted that although the CSM covers all anticipated human exposure at the Site, this Interim ROD is focused on addressing the highest human health threat at the Site, namely, the exposure of child residents to lead in residential property surface soil and the resulting contaminated indoor dust via incidental ingestion.

Sampling Strategy: Surface soil sampling of residential properties was performed similarly to the approach taken during previous removal actions. As indicated earlier, approximately 3,100 residential properties all across Madison County have had their soil sampled and analyzed for metals. The sampling generally involved dividing a residential property into four quadrants and compositing nine aliquots of surface soil from each quadrant. Typically, separate multi-aliquot samples were collected from gardens, child play areas, and non-paved driveways. Samples were analyzed using an XRF instrument. A small percentage of soil samples were sent off-site for laboratory confirmation analysis.

Additionally, a limited set of indoor dust samples and drinking water samples from private potable wells was collected for use in the HHRA. Potable water samples were collected from 43 homes using individual wells and analyzed for heavy metals in a laboratory. Prior to collection, water was allowed to flow from the tap for at least two to three minutes to purge the water pipe. Indoor dust samples were collected by a high volume vacuum from 43 unremediated homes that had surface soil concentrations in their respective yards ranging from below 250 ppm to greater than 1,500 ppm. These indoor dust samples were collected from homes constructed after 1980 in order to avoid any lead-based paint impact on the dust and were analyzed in a laboratory.

In the HHRA, as summarized in the next section, lead was identified as the primary contaminant of concern (COC). Other metals were identified in various media and locations as COCs in select situations. However, the Interim ROD focuses on lead since it is generally the primary COC in a residential property setting in a lead mining area. Lead is a metal and a constituent of D008 hazardous waste. It is classified by the EPA as a probable human carcinogen and is a cumulative toxicant. The organic form of lead is generally unstable and undergoes rapid conversion to inorganic lead compounds. Most forms of inorganic lead are relatively insoluble, tend to bind tightly to soil, and are not very mobile.

Quantity of waste and concentrations of lead in soil: The total number of residential properties with lead-contaminated surface soil across Madison County that will be addressed under this remedial action is estimated at 1,100 properties. This number comes from properties with measured lead soil concentrations greater than 400 ppm (786 properties), and an estimated number of properties not yet sampled but that potentially could exceed 400 ppm lead in surface soil (314 properties). The action level for lead in residential surface soil, 400 ppm, is based on the site-specific HHRA described in the next section and assumes lead is measured in the bulk soil sample with an XRF instrument. As shown on Figures 3 and 4, the properties already identified for cleanup are scattered across Madison County.

The number of residential properties not yet sampled but that potentially could require remediation is estimated to be 314 properties and is calculated as follows. It is estimated that approximately 748 residential properties in Madison County have not yet been sampled. Historically, 42% of the properties actually sampled in Madison County contained lead concentrations greater than 400 ppm. Assuming the same percentage of the properties that have not yet been sampled contain lead concentrations greater than 400 ppm, the number of properties with lead levels greater than 400 ppm is estimated at 314 properties. Therefore, when adding the number of properties that are known to need remediation (786 properties) and the number of properties which are estimated to need remediation (314 properties), the total number of residential properties expected to be addressed under this remedial action is estimated to be 1,100 properties.

Based on EPA's previous soil removal activities in and around Fredericktown, an average residential property has approximately 186 yd^3 of lead-contaminated soil. Therefore, it is estimated that approximately 206,460 yd^3 of residential soil is contaminated with lead above 400 ppm at the Site. Lead concentrations in unremediated residential surface soil tested to date range from approximately 20 ppm to over 12,000 ppm.

Lateral and vertical extent of contamination and likelihood of migration: There is considerable variability in lead concentrations found in surface soil at residential properties across Madison County, both from property to property and within each individual property. The actual use and amount of mine waste used as fill on a property, as well as how well it was mixed with existing soil, would greatly affect lead soil concentrations at a residential property. Later modification of residential properties resulting from filling, grading, or other activities could either cover or dilute lead contamination at the surface. Erosion of surface soil during rain events can relocate lead-contaminated soil. High water and extensive rain events have moved mine waste from their source piles onto residential properties, increasing lead contamination at those properties. It is likely that a combination of these factors has resulted in the observed discontinuous horizontal nature of lead contamination in soil at residential properties across the county. The vertical extent of lead contamination in residential soil also varies as indicated during the previous removal actions. Humans residing at the residential properties impacted by surface soil with lead concentrations above 400 ppm are potentially exposed through routes of ingestion and dermal contact.

CURRENT AND POTENTIAL LAND USE

The primary land use within Madison County since mining operations ended is agricultural crop and pasture land. Industrial activities consist of light manufacturing, aggregate production, and construction. The population is predominantly rural. According to census data, the population of Madison County was 11,800 in 2000, including 4,711 households and 3,300 families. In addition, the county has approximately 270 business structures, 6 schools, 400 farms, 16,000 miles of paved roads and streets, 800 miles of public unpaved roads, 1 major river, 1 secondary river, and 2 water supply districts. Residential properties addressed by this remedy are expected to be used for the same purpose in the future.

SUMMARY OF SITE HUMAN HEALTH RISKS

A baseline HHRA dated July 9, 2007, (included in the AR as an RI appendix) was conducted for the Site to assess the potential risks to humans, both now and in the future, from site-related contaminants present in environmental media including surface soil, indoor dust, sediment, surface water, groundwater, and fish tissue. The HHRA assumes that no steps are taken to remediate the environment or to reduce human contact with contaminated environmental media. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. The results of the risk assessment are intended to help inform risk managers and the public about potential human health risks attributable to site-related contaminants and to help determine if there is a need for action at the Site. For most heavy metals, the chemicals of potential concern (COPCs) at the Site, the HHRA follows the standard risk assessment process: (1) identification of contaminants of potential concern, (2) exposure assessment, (3) toxicity assessment, and (4) risk characterization. However, as explained in more detail later, the toxicity and exposure assessments as well as the risk characterization for lead are intrinsically included in the **Integrated Exposure Uptake Biokinetic (IEUBK) model** used to evaluate potential lead effects on human health. This section of the Interim ROD summarizes the results of the HHRA.

COPCs are chemicals which exist in the environment at concentrations that might be of potential health concern to humans and which are or at least might be derived in part from site-related sources. At mining sites, the COPCs are generally metals and other inorganic chemicals that occur in mine waste. Given the large number of COPCs at the Site and the high number of media they can impact, Table 1 lists the COPCs as identified by the HHRA. Further detailed information on the number of samples, their locations, the media from which they were collected, the number of detections, and range of concentrations is included in the RI. In contrast, COCs are those chemicals which exist in the environment and have been shown by a risk assessment to be of concern to human health. Ultimately in the HHRA, lead was the most frequently identified COC and is the primary risk driver for the remedial action described in this document. Other substances such as aluminum, antimony, arsenic, chromium, iron, manganese, nickel, thallium, and vanadium in soil and in groundwater fluoride, and on a more limited basis manganese, cadmium, selenium, arsenic, iron, zinc, and chromium contributed to site risks. The Interim ROD focuses on lead because it is the primary COC at the residential property portion of this OU in Madison County. Lead ranged from approximately 20 to over 12,000 ppm in residential surface soil at approximately 3,100 residential properties.

Exposure pathways and exposed populations: Figure 2 presents the CSM which shows the variety of exposure pathways by which Site-related COPCs may migrate from on-Site mine waste piles acting as sources of contamination for other environmental media such as soil and indoor dust. The CSM also shows the various human populations that might reasonably be exposed to heavy metals and in particular lead in the environment. However, not all of these potential exposure pathways are likely to be of equal concern. Additionally, with respect to residents, two potential exposure scenarios were not quantitatively addressed in the HHRA. First, exposure to heavy metals by ingestion of garden vegetables is a complete pathway but data from vegetables have not been collected. Second, exposure to heavy metals in roads and alleys was not quantified because the extent of that exposure is not known with certainty.

With respect to lead contamination, young children (typically defined as seven years of age or below) across Madison County are the population group of primary concern potentially exposed at the Site. Young children are more susceptible to lead exposure than adults because they have higher contact rates with soil or dust, absorb lead more readily than adults, and are more sensitive to the adverse effects of lead than are older children and adults. Thus, the most important exposure pathway for children is incidental ingestion of soil and dust. The effect of greatest concern in children is impairment of the nervous system, including learning deficits, lowered intelligence, and adverse effects on behavior.

The risks or potential for adverse health effects from lead are evaluated using a different approach than for most other metals. Because lead is widespread in the environment, exposure can occur by many different pathways. Thus, lead risks are based on consideration of total exposure (all pathways) rather than just site-related exposure. Because most studies of lead exposures and the resultant health effects in humans have traditionally been described in terms of blood lead level (expressed in µg/dL), lead exposures and risks are typically assessed using mathematical models. Additionally, because lead does not have nationally-approved toxicological values which can be used to assess risk, standard risk assessment methods cannot be used to evaluate the health risks associated with lead contamination. Therefore, the HHRA used EPA's IEUBK Model for Lead in Children to estimate the distribution of blood lead levels in a population of residential children exposed to lead at the Site. Typically, the focus of an HHRA with respect to lead in a residential setting is on children since they are at a greater risk than older children or adults. For this HHRA the Adult Lead Model was also used. By using a lead model for the population at greatest risk, namely children, adults are also protected (including pregnant women.) Thus, the IEUBK model was used to evaluate the risks posed to young children (0 to 84 months) as a result of the lead contamination at the Site.

In the case of lead, risks are evaluated using a somewhat different approach, namely, the IEUBK model, which can be used to evaluate all exposure pathways. The IEUBK model uses site-specific and default inputs (i.e., surface soil concentration, indoor dust concentration, bioavailability, etc.) to evaluate exposure from lead in surface soil, drinking water, dust, and ambient air to estimate the probability that a child's blood lead level might exceed 10 µg/dL. EPA's health protection goal is that there should be no more than a 5% chance of exceeding a blood lead level of 10 µg/dL in a given child or group of similarly-exposed children. The basis for this goal is that the Centers for Disease Control and Prevention and EPA have conducted analyses demonstrating health effects at or below a blood lead level of 10 µg/dL.

For a residential child, the IEUBK model was run for each individual residential property because most exposure for a young child will occur at their residence using available Site-specific data. First, surface soil lead concentrations, represented by concentrations in soil particles less than 250 micrometers (μm), at 970 individual unremediated residential properties were included in the HHRA. Second, paired soil and indoor dust data collected from 43 unremediated residential properties were used to estimate indoor dust lead concentrations. Finally, testing was performed to estimate the relative bioavailability or the amount of lead absorbed into the body from the gastrointestinal tract following ingestion of lead-contaminated soil. The results indicated that uptake of lead at the Site is greater than the IEUBK model default value. Default inputs were used for the remaining input parameters.

<u>Risk results for residents from surface soil:</u> Of the 970 residential properties evaluated during the HHRA, children residing at 171 properties (18%) are predicted to have greater than a 5% chance of exceeding a blood lead level of 10 μg/dL. Children in the remaining 799 homes (82%) are predicted to have blood lead levels at or below EPA's health protection goal. Table 2 summarizes the risks to residents from exposure to lead in surface soil. The risk assessment results indicate that a child exposed to residential property lead surface soil concentrations above 400 ppm would have greater than a 5% chance of exceeding a blood lead level of 10 μg/dL. To clean up to 400 ppm, the surface soil sample should be sieved with a #10 mesh sieve to obtain particles less than 2 millimeters (i.e., the bulk soil fraction) and can be analyzed with an XRF instrument. These results indicate that approximately 1,100 unremediated homes in Madison County are of potential health concern with regard to lead.

Other metals were identified in various media and locations as COCs in select situations. The HHRA determined that surface soil at several residential properties may present a noncancer risk to children from a number of heavy metals, excluding lead, at the maximum sample concentration. It is important to note that if these risks were based on average heavy metal concentrations in soil, the residential property surface soil would not exceed a level of concern for children. However, at residential properties where heavy metals in surface soil present a risk to children and are co-located with lead, EPA will address this risk under this proposed remedial action. A determination will be made in the final ROD for OU-3 on addressing the remaining residential properties where heavy metals other than lead may present potential health risks. Further details may be found in the HHRA.

<u>Risk estimates for residents from groundwater:</u> As shown in Table 2, exposure to concentrations of lead in groundwater does not result in predicted blood lead levels exceeding EPA's health-based goal for current child residents at most locations, with the exception of two wells located in Fredericktown. It should be noted that subsequent resampling of these private potable wells yielded lead concentrations in the groundwater below the lead Maximum Contaminant Level (MCL). However, in order to be protective, these wells will be provided with filters and further evaluated during the remedial action. A final determination on these wells will be made in the final ROD for OU-3.

With regard to other COPCs, there does not appear to be a noncancer risk to the majority of current child and adult residents from ingestion of groundwater from private water wells, although there are some risks exceeding a level of concern for current residents at a number of wells. These results can be reviewed in the HHRA. In most cases, this risk is associated with elevated levels of fluoride with additional contributions from other COPCs. The Madison

County Health Department has indicated that portions of northwestern Madison County have shown elevated fluoride concentrations in the past. The majority of the private water wells that potentially pose a noncancer risk to residents are located in the northwestern part of Madison County. Therefore, these wells may well reflect background concentrations. Additionally, the three drinking water well samples that yielded results greater than their respective MCLs yielded results below the MCLs upon resampling. The three wells whose initial results were above MCLs will be provided with filters and further evaluated during the remedial action. After further evaluation, a determination will be made in the final OU-3 ROD on addressing the remaining residential properties where heavy metals in groundwater may present a potential health risk.

Uncertainties: Quantitative evaluation of the risks to human health from environmental contamination is frequently limited by uncertainty regarding a number of key data items, including concentrations in the environment, the true amount of human contact with contaminated media, and the true dose-response curves for noncancer and cancer effects in humans. This uncertainty is usually addressed by making assumptions or estimates for uncertain parameters based on whatever limited data are available. Because of these assumptions and estimates, the results of risk calculations are themselves uncertain, and it is important for risk managers and the public to keep this in mind when interpreting the results of a HHRA. In most cases, assumptions employed in the HHRA to deal with uncertainties were intentionally conservative. Thus, they are more likely to lead to an overestimate rather than an underestimate of risk.

Summation

With respect to the primary COC, final cleanup levels for lead in residential property surface soil at Superfund sites are based on the IEUBK model results and the nine criteria analysis included in this Interim ROD in accordance with the NCP at 40 C.F.R. § 300.430(e)(9)(iii) and incorporated by reference at 40 C.F.R. § 300.430(f). EPA generally selects a residential surface soil cleanup level within the range of 400 ppm to 1,200 ppm for lead, although lower or higher cleanup levels are possible based on input of site-specific data into the model. As described above, the IEUBK modeling results for the Site recommend a maximum lead surface soil concentration of 400 ppm to ensure that a child has less than a 5% probability of having a blood lead level exceeding 10 µg/dL.

The response action selected in this Interim ROD is necessary to protect public health from actual releases of pollutants or contaminants from this Site which may present an imminent and substantial endangerment to public health or welfare. This Interim ROD only addresses human health risk at residential properties within Madison County. Therefore, while an Ecological Risk Assessment was completed for the Site, a summary of it has not been included in this Interim ROD. Other identified risks to human health and the environment will be addressed in future cleanup decisions.

REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) consist of quantitative goals for reducing human health and environmental risks and/or meeting established regulatory requirements at Superfund sites. RAOs are identified by reviewing site characterization data, risk assessments, applicable or relevant and appropriate requirements (ARARs), and other relevant site information.

Based on current site data and evaluations of potential risk, lead was identified as being a COC. The primary cause of human health risk from residential property soil at the Site is through direct ingestion (by mouth). A single RAO has been established for residential property surface soil at the Site that is consistent with EPA guidance including the Superfund Lead-Contaminated Residential Sites Handbook. Thus, the RAO for the residential property soil at the Site is to:

> ***Reduce the risk of exposure of young children (children under seven years old) to lead such that an individual child or group of similarly exposed children have no greater than a 5% chance of exceeding a blood lead level of 10 μg/dL.***

By meeting this RAO, unlimited use of and unrestricted exposure to Site surface soil by young children will not result in an unacceptable health risk. Based on Site-specific information, EPA's IEUBK model predicts that a young child residing at the Site will have greater than a 5% chance of having a blood lead level exceeding 10 μg/dL if the lead soil concentrations to which he or she is exposed are above 400 ppm under the assumed exposure conditions. Thus, 400 ppm lead in surface soil will be the cleanup level of the remedial action as measured in the bulk soil fraction using an XRF instrument.

DESCRIPTION OF ALTERNATIVES

Description of Remedy Components

Three alternatives were developed in the Focused FS to meet the identified RAO. The alternatives were developed to specifically address lead-contaminated residential surface soil. With the exception of phosphate stabilization as part of Alternative 3, Alternatives 2 and 3 have common elements. Operation and maintenance (O&M) activities are not included in any of the alternatives because this is an Interim ROD. O&M activities will be included in the final ROD for OU-3.

Alternative 1: No Action

The NCP at 40 C.F.R. § 300.430(e)(6) requires that EPA consider a no-action alternative against which other remedial alternatives can be compared. Under this alternative, no further action would be taken to monitor, control, or remediate the threat of lead in residential property soil in Madison County. Alternative 1 would not meet the RAO because it does not minimize or eliminate the existing or future potential exposure at the Site.

Alternative 2: Excavation, Disposal, Vegetative Cover, and Institutional Controls

- Excavation and removal of surface soil above 400 ppm lead to soil with lead below 400 ppm or to a depth of 12 inches. Excavation will continue to a depth of 24 inches bgs if it is determined that a lead concentration below 1,200 ppm lead can be reached.
- Clean fill and topsoil replacement along with revegetation
- Disposal of excavated soil at a repository
- Health education
- ICs pilot project

Under this alternative, residential properties with at least one quadrant surface soil sample testing greater than 400 ppm for lead will have that quadrant removed and replaced. If the drip zone surface soil sample from any property where a soil quadrant is being replaced also exceeds a concentration of 400 ppm lead, the property will also have the drip zone soil removed and replaced. Residential properties where only the drip zone soil and no other quadrant soil exceeds 400 ppm lead would not be addressed in this action. Based on existing surface soil sampling data and trends in that data, 1,100 residential properties contain or are expected to contain lead surface soil concentrations greater than 400 ppm and will require remediation. This alternative includes the excavation and removal of lead-contaminated surface soil, backfilling the excavation with clean soil, and revegetation.

In general, excavation will continue in depth until the underlying soil at the bottom of the excavation is less than 400 ppm lead or to a maximum depth of 12 inches bgs, whichever is less. If at 12 inches bgs the lead soil concentration is greater than 1,200 ppm, EPA will excavate deeper if EPA determines that by further excavation a lead concentration of less than 1,200 ppm can be achieved. If EPA determines this cannot be achieved by further excavation, EPA will place a barrier at 12 inches bgs. The excavated soil will be disposed at the Conrad tailings pile or an alternate location depending on the capacity of the Conrad tailings pile. Clean fill and topsoil will be used to replace excavated soil, returning the residential property to its original elevation, grade, and potential. The property typically would then be hydroseeded to restore the original vegetation unless conditions warrant sodding. The estimated time for the cleanup of the 1,100 properties is approximately four years. Future land use is expected to continue to be residential.

With regard to ICs, a public health education program would be implemented to address short-term risk during excavation. Additionally, an ICs pilot project would be developed to further evaluate and develop ICs with the local citizens and government stakeholders input. In particular, EPA will ultimately need ICs to ensure that the barriers and the soil below them remain undisturbed and to ensure future development is protective of human health. During the ICs pilot project, EPA hopes to obtain community comments and acceptance. EPA is required to consider community acceptance as a factor when selecting a remedy, including ICs, pursuant to 40 C.F.R.§ 300.430 (f)(i)(C). Because of the large number of properties affected, this effort will require a projected one to three years.

Alternative 3: Phosphate Stabilization, Excavation/Disposal, and Institutional Controls

- Phosphate stabilization of residential surface soil at lead levels within an effective treatment range as demonstrated by a Site-specific treatability study, which is estimated for costing purposes to be between 400 and 800 ppm
- Excavation of residential surface soil exceeding 800 ppm lead
- Soil disposal, clean fill and topsoil replacement, and revegetation, same as Alternative 2
- Health education, same as Alternative 2
- ICs pilot project, same as Alternative 2

Just as in Alternative 2, under Alternative 3, residential properties with a quadrant showing a quadrant sample result greater than 400 ppm lead will be remediated. Additionally, the drip zone will be remediated if the composite surface soil sample from the drip zone has a lead level greater than 400 ppm and at least one other quadrant requires soil remediation. Residential properties where only the drip zone soil exceeds 400 ppm lead would not be addressed in this action. Under this alternative, 1,100 residential properties are expected to require remediation. Just as under Alternative 2, if upon excavating to 12 inches bgs the lead soil concentration remains above 1,200 ppm, EPA will excavate to 24 inches bgs if it is determined that a lead concentration of less than 1,200 ppm can be achieved. Otherwise, EPA will place a barrier at 12 inches bgs prior to backfilling. Under Alternative 3, all residential properties with lead surface soil concentrations exceeding 400 ppm but less than 800 ppm (an assumed concentration for costing purposes only) would be treated with phosphate. This alternative would not be implemented until a Site-specific treatability study was completed to assess the effectiveness of phosphate stabilization on reducing lead bioavailability. The final decision to proceed with phosphate stabilization of properties would be made by EPA after peer review of the treatability study and public comments on the study. A long-term monitoring program would be instituted to assess the effectiveness of phosphate stabilization. Assuming a successful treatability study, the estimated time to implement this action is projected to be four years.

For residential properties with lead surface soil concentrations above 800 ppm, EPA will remediate these properties as outlined in Alternative 2 through excavation, disposal, and backfilling. The repository, vegetation restoration, health education, and IC pilot project components of Alternative 3 are the same as Alternative 2. Just as under Alternative 2, future land use under Alternative 3 is expected to be residential.

Common Elements and Distinguishing Features of Each Alternative

Alternative 1 is removed from consideration because it is not protective of human health and the environment and does not meet ARARs. The two remaining alternatives, Alternatives 2 and 3, include the common elements of the selected repository (Conrad tailings pile), vegetation restoration, health education, and IC pilot project. Both alternatives are similar in their attainment of key ARARs if the phosphate stabilization treatability study proves successful for Alternative 3. The costs of both alternatives are similar, with Alternative 2 projected to cost approximately $24.4 million while Alternative 3 is projected to cost approximately $23.7 million. The key distinguishing features of these two alternatives are the number of yards to be excavated and the potential use of in-situ phosphate stabilization in lieu of excavation and replacement.

Alternative 2 involves the excavation of all residential properties where a quadrant's sample exceeds 400 ppm for lead and does not provide in situ treatment. This alternative would be a final soil remedy for 1,100 properties, the greatest number of properties of any of the alternatives.

Alternative 3 includes a combination of excavation and treatment to achieve the RAO for the estimated 1,100 residential properties at the Site with lead surface soil levels above 400 ppm. Excavation and replacement of lead-contaminated surface soil would be performed for an estimated 558 residential properties that exceed 800 ppm for lead, which is the anticipated treatment limit for phosphate stabilization. Concurrent with the excavation of these 558 properties, a treatability study would be performed to determine the effectiveness of phosphate stabilization to treat lead-contaminated surface soil with concentrations between 400 and 800 ppm lead . A treatability study is needed because phosphate stabilization of lead-contaminated residential soil has never been applied at a full-scale at lead-mining Superfund sites. If a phosphate stabilization treatability study were successful, the remaining 552 residential properties would be treated using this technology.

The primary distinction between Alternatives 2 and 3 involves the reliance upon a proven, conventional approach to remediation (excavation and replacement) versus consideration of a promising, yet unproven technology (in situ phosphate stabilization treatment) to reduce risks in lead-contaminated surface soil to acceptable levels. Phosphate stabilization or treatment has been demonstrated to reduce bioavailability in some cases, thereby reducing risks associated with contaminated soil. For instance, an extended study of phosphate stabilization at the Oronogo-Duenweg Site in Jasper County, Missouri has achieved a maximum of 40% reduction in bioavailability over a 7 year study period. However, the effectiveness of this technology under conditions at the Site remains uncertain. Soil type and chemistry can be expected to impact the effectiveness of this type of technology. For this reason, a treatability study that successfully demonstrates the effectiveness of this technology applied to Site-specific residential soil is required before phosphate stabilization could be considered and applied at this Site. The long-term protectiveness and effectiveness of a surface soil excavation and replacement remedy, by comparison, are more assured.

Significant differences also exist between excavation and treatment with regard to management of lead-contaminated residential soil above 400 ppm. Under Alternative 2, excavation and replacement of lead-contaminated soil requires final management of this soil at a disposal location, such as a mine waste pile. The residual health risk associated with excavated soil would be controlled with ICs, such as restrictive covenants, to restrict future land use at the soil repositories and through engineering controls at the soil repository or repositories. In contrast under Alternative 3, if phosphate stabilization proved successful and treatment was used at a number of contaminated properties, treated surface soil would remain at the surface in treated areas. Residual risks associated with direct contact with the treated surface soil would be reduced to the acceptable level of 400 ppm lead by the treatment process.

The design timeframes and implementation associated with Alternatives 2 and 3 are very different. Alternative 2 requires very little design because similar residential property cleanups have previously occurred at a number of Superfund sites within the Region as well as at OU-1 and OU-3 at this Site. Additionally, excavation and replacement of contaminated surface soil is the conventional approach to lead-contaminated soil remediation and uses readily available equipment and standardized procedures. In contrast, a treatability study would be required that successfully demonstrates the safety and long-term effectiveness of the treatment technology and could require up to 3 or more years than Alternative 2 to complete. While Alternative 2 is expected to take four years, Alternative 3 could take more than a decade to complete with the inclusion of the treatability study. If the treatability study did not demonstrate the effectiveness and permanence of the treatment technology, an alternate remedy would be required for the approximately 552 residential properties with lead surface soil concentrations between 400 ppm and 800 ppm, resulting in further delays.

Long-term effectiveness and permanence factors are also different for Alternatives 2 and 3. For Alternative 2, at a residential property where no barrier is placed at depth, excavation and replacement of lead-contaminated surface soil provides immediate protection and permanence by removing contaminated surface soil to prevent potential human exposure. The long-term reliability of the remedy is assured at these properties by virtue of there being no surface soil with lead levels greater than 400 ppm. At properties where a plastic barrier is placed at depth, long-term reliability is high due to the placement of at least 12 inches of clean soil. This soil acts as a soil barrier between people and soil contaminated above the cleanup level, protecting human health. The rationale for establishing a minimum clean soil thickness of 12 inches is that the top 12 inches of soil is considered available for direct human contact. The remedy's permanence, in the case of properties with plastic barriers at depth, is tied to protecting the physical barrier. This will be addressed by ICs that will be evaluated during the ICs pilot project and chosen within a few years in the final ROD for OU-3. In contrast, the phosphate stabilization part of Alternative 3, would require a long-term monitoring program to assess the long-term reliability and permanence of phosphate stabilization, since previous studies are inconclusive.

As part of Alternative 3, the use of phosphate stabilization would constitute an innovative remedy for lead-contaminated residential surface soil at the Site that would reduce toxicity. CERCLA establishes a statutory preference for remedies involving treatment that reduce the toxicity, mobility, or volume of hazardous substances. In comparison, Alternative 2, with its reliance on excavation, removal and disposal, does not treat or reduce the toxicity or volume of the hazardous substances (the lead-contaminated residential surface soil.) However, the mobility of this soil would be reduced by its consolidation and control at a soil repository such as the Conrad tailings pile.

Expected Outcomes of the Alternatives

Both excavation and replacement of contaminated surface soil, and implementation of successfully-demonstrated phosphate stabilization would allow for unrestricted future use of the majority of remediated properties. Under both alternatives, it is anticipated that a small overall number of physical barriers will be required for placement at depth to indicate lead-contaminated residential soil below them. Therefore, ICs will ultimately be needed and chosen in the final ROD for OU-3. Residential use of all these properties could continue under either approach.

Both excavation and replacement of soil and soil treatment are implementable, although phosphate stabilization has not been proven as an effective or permanent remedy and could only be used after a successful treatability study.

The time frame to achieve cleanup goals is different for the alternatives. Excavation and soil replacement of a single property is typically performed within approximately five days. In comparison, phosphate stabilization of a property is expected to take approximately 15 days, meaning it would take approximately three times as long to remediate each residential property using phosphate stabilization. Hydroseeding would be applied under both alternatives and would require the same amount of additional time under either Alternative 2 or 3. Hydroseeding can require considerably more time and daily care to establish vegetation, depending on the season.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

According to the NCP, nine criteria are used to evaluate the different alternatives individually and against each other in order to select the best remedy. The nine evaluation criteria are (1) overall protection of human health and the environment; (2) compliance with ARARs; (3) long-term effectiveness and permanence; (4) reduction of toxicity, mobility, or volume of contaminants through treatment; (5) short-term effectiveness; (6) implementability; (7) cost; (8) state/support agency acceptance; and (9) community acceptance. This section of the Interim ROD profiles the relative performance of each alternative when measured against the nine criteria and each other. The nine evaluation criteria are discussed below. A detailed analysis of these alternatives can be found in the Focused FS Report.

1. <u>Overall Protection of Human Health and the Environment</u>: Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, and/or ICs.

Alternative 1 does not provide protection for the environment or residents in Madison County because no actions are taken to mitigate the exposure to lead-contaminated surface soil. Alternative 2 would remove the significant exposure pathway of direct contact from contaminated residential property surface soil by excavating it and replacing that soil with clean soil. Once excavation, soil replacement, and revegetation is complete; the soil is properly disposed; enforceable ICs are implemented; and an effective health education program is implemented; the risk of exposure through direct contact with metal-contaminated residential property soil will be mitigated. Therefore, Alternative 2 is protective of human health and the environment.

As part of Alternative 3, a treatability study using residential property soil would be required to show that phosphate treatment of surface soil with lead concentrations between 400 ppm and 800 ppm would reduce the bioavailability of lead at the Site to levels that are protective of human health and the environment. Alternative 3 is protective of human health and the environment only if the phosphate treatment significantly reduces the bioavailability of lead on a long-term basis. At this time, extended study of the technology at the Oronogo-Duenweg Superfund Site in Jasper County, Missouri, has achieved a maximum of 40% reduction in bioavailability over a seven year study period. However, the technology has not undergone any implementability testing at a residential property by EPA. A recent review of the technology at the Omaha Lead Site entitled "Evaluation of Phosphate Treatment at Residential Properties; Omaha Lead Site, Omaha, Nebraska" has indicated concern about implementability, cost effectiveness and community acceptance in a residential setting, as well as the long term presence and monitoring of lead in the soil even if its bioavailability has been reduced. Therefore, the protectiveness of soil treatment is less assured at this time compared to conventional surface soil excavation and replacement.

2. Compliance with ARARs: Section 121 (d) of CERCLA and the NCP at § 300.430(f)(1)(ii)(B) require that remedial actions at Superfund sites at least attain legally applicable or relevant and appropriate federal and state requirements, standards, criteria, and limitations which are collectively referred to as ARARs, unless such ARARs are waived under CERCLA § 121(d)(4). Therefore, this criteria evaluates whether the alternative meets federal and state ARARs that pertain to the site or whether a waiver is justified. Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a Superfund site. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a Superfund site, address problems or situations sufficiently similar to those encountered at the Superfund site that their use is well-suited to the particular site. State standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be applicable or relevant and appropriate.

The ARARs for this Interim ROD are included in attached Tables 3 through 8. The no-action Alternative does not comply with ARARs. In contrast, Alternative 2 and the excavation portion of Alternative 3 would comply with chemical and location-specific ARARs. However, whether the phosphate stabilization treatment of surface soil with lead levels between 400 and 800 ppm under Alternative 3 would meet ARARs is dependent on the results of a treatability study. Action-specific federal and state ARARs would be achieved by making sure all surface soil above the cleanup level is excavated, transported, and disposed of properly. Storm water runoff will be kept to a minimum during excavation, soil replacement, and hydroseeding using best management practices, thus keeping local streams free of additional sediment. To minimize exposure to the residents, dust suppression will be used during all phases of construction and time spent at each residence will be kept to a minimum. All precautions will be considered at each location to ensure that excavation will not hinder or interfere with wildlife and local streams.

Having failed to meet both previous criteria, called the threshold criteria, Alternative 1, the No Action Alternative, is eliminated and will not be included in further NCP criteria analysis.

3. Long-term Effectiveness and Permanence: Long term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup levels have been met. This criterion includes the consideration of residual risk that will remain on-site following remediation and the adequacy and reliability of controls.

Alternatives 2 and 3 reduce residual risks for all properties which have contaminated surface soil excavated and replaced. The removal of contaminated surface soil, replacement with clean soil, and revegetation ensures that future potential for exposure will be significantly reduced. However, whether the phosphate stabilization part of Alternative 3 can effectively protect human health over time depends on the results of the treatability study. Previous studies are inconclusive as to whether phosphate treatment results in long-term reduction in the bioavailability of lead in soil. Treatment of residential soil using a phosphate amendment has not been implemented during a full-scale remediation project. The bench and pilot scale studies that have been performed have had mixed results, although the previous studies have generally indicated that the bioavailability of lead was not reduced by more than 50%. The long-term effectiveness under Alternative 3 for phosphate treatment of lead concentrations between 400 and 800 ppm would be determined by the results of the treatability study.

A significant aspect of Alternative 2 and the excavation portion of Alternative 3 is the placement of the excavated contaminated soil at the Conrad Repository. The repository would require storm water and erosion controls and other design and engineering controls for long-term effectiveness and permanence.

A significant component of Alternatives 2 and 3 which impact long-term protectiveness of excavated properties is the ICs pilot project, which will ultimately be used to determine effective ICs for the final OU-3 ROD. For example, an ordinance restricting digging in areas where barriers were placed at depth over soil contaminated with lead above 1,200 ppm, restrictive covenants, or a requirement for building permits could ensure long-term protectiveness of Alternative 2 and 3. EPA will work with local citizens and government officials at all levels to assess the use and implementability of ICs such as ordinances and restrictive covenants.

Reviews at least every five years would be necessary for Alternatives 2 and 3 to evaluate the effectiveness of these alternatives because lead surface soil concentrations above the health-based level of 400 ppm may remain at some residential properties beneath plastic barriers. Additionally, long-term protectiveness and permanence of phosphate treatment employed as part of Alternative 3 would require long-term monitoring, which would also be covered under Five-Year Reviews.

4. Reduction of Toxicity, Mobility, or Volume of Contaminants Through Treatment: Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

Alternative 2 and the excavation portion of Alternative 3 do not include treatment of the lead-contaminated residential surface soil but would significantly reduce the mobility of the COCs by consolidation of the excavated contaminated soil at the Conrad tailings pile. Although the exposure pathway via residential surface soil would be eliminated or minimized, the toxicity and volume of the material would not be reduced by these alternatives with the exception of the treated and stabilized soil which would otherwise fail the Toxicity Characteristic Leaching Procedure (TCLP) for lead. The toxicity of the stabilized soil would decrease, although the volume of this soil is not expected to be a significant portion of the excavated residential soil. Proper long-term maintenance of the Conrad Repository is an important component of Alternatives 2 and 3 to ensure significant reduction of heavy metal mobility.

Alternative 3 is the only alternative that involves in situ treatment and it would reduce the toxicity and mobility of lead through phosphate stabilization of surface soil with lead levels between 400 ppm and 800 ppm. Phosphate stabilization transforms the lead in contaminated soil into a form that is less leachable and less bioavailable. The reduced leachability reduces the mobility of the lead in the environment. The reduced bioavailability lowers the toxicity of lead to exposed individuals.

5. Short-term Effectiveness: Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community and the environment during construction and operation of the remedy until cleanup levels are achieved.

Alternative 2 has some short-term risks for the public, environment, and construction workers from excavation and transportation efforts. Disturbed contaminated soil could enter the ambient air during excavation and transportation. However, dust suppression would be implemented for the protection of the community and workers during the remedial action. The alternative would require years to implement for all affected residences. However, the length of time at any one residence to excavate and remove surface soil, backfill with clean fill and topsoil, and revegetate would be minimal. Therefore, the residential exposure to dust would be minimal. Because the most material is excavated and transported under Alternative 2, risks associated with the use of heavy construction equipment and transportation are greater for this alternative than Alternative 3.

The time required to achieve cleanup levels through phosphate stabilization can only be determined through a successful treatability study that demonstrates its effectiveness on Site soil. Typically, reagents are tilled into the surface soil and allowed to remain in place for approximately 7 to 10 days. Treated soil is then neutralized and revegetated. The time required to implement a phosphate stabilization remedy is approximately 15 days. Soil treatment could proceed at multiple properties simultaneously.

Alternative 3 has slightly higher risks than Alternative 2, such as exposing construction workers and the community to contaminated soil and dust for approximately 15 days instead of 5 days. Additionally, Alternative 3 exposes workers, residents, and animals to phosphoric acid and lime. Depending on the method used to apply the phosphoric acid, there would be a risk to workers and property from aerosol spray. Workers would be required to wear protective clothing (including respiratory protection) during the application of the phosphoric acid.

6. Implementability: Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

Alternative 2 and the excavation portion of Alternative 3 are readily implementable because it is technically feasible from an engineering perspective. Excavation methods, backfilling, and revegetation are typical and easy engineering controls. Excavation and replacement of contaminated surface soil is performed using conventional earth moving equipment and hand tools, and can be readily performed by trained operators and laborers. The experience of previous Site removal actions conducted by EPA at this and other lead mining Superfund sites has shown that Alternative 2 and the excavation portion of Alternative 3 is readily implementable.

The phosphate treatment portion of Alternative 3 would be more difficult to implement. The application of the phosphoric acid treatment on residential properties has not been attempted on a large scale. This treatment alternative uses 85% phosphoric acid which can cause skin irritation as well as damage to the respiratory system of workers if not handled properly. Phosphoric acid is viscous, making application difficult, and it may crystallize in winter. The phosphoric acid could damage the exterior of a structure such as a home or personal property around the home if the acid is not carefully applied. The property would have to be fenced prior to the application of the phosphoric acid to restrict access to the property during treatment of the property. The fence would have to remain until the lime was applied and the property was revegetated. Small animals and birds would still have access to the property and contact with the soil prior to the application of the lime could pose a health risk to them.

The ICs pilot project is a component of Alternatives 2 and 3 as well and will require implementation. Coordination between federal, state, county, and local governments and interested citizens is required to discuss and evaluate proprietary controls, such as restrictive covenants, easements or governmental controls such as an ordinance or building permit requirements.

7. <u>Cost</u>: Includes estimated capital costs as well as present worth costs. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 %.

The present worth cost for Alternative 2 is estimated to be $22.4 million. The present worth cost for Alternative 3 is estimated to be $21.8 million. For both cost estimates, capital costs are spread over a construction period of four years. A 3.5% discount rate was used to calculate the present worth. These estimates are approximate and made without detailed engineering data. The actual cost of the project would depend on the final scope of the remedial action, actual length of time required to implement the alternative, and other unknown factors.

The historical average amount of soil removed from each property is 186 yd^3 at a construction only cost of $63 per yd^3. These estimates are averages of past construction activities on this Site but future costs could well vary. Annual costs of $125,000 are estimated for public health education. No annual O&M costs are incorporated in the cost estimates since this is an Interim ROD and O&M will be included in the final ROD for OU-3. For Alternative 3, the phosphoric acid treatment estimated costs are $12,305 per property. The cost of phosphate treatment can vary based on material and equipment availability, transportation, and the method of treatment.

8. <u>State/Support Agency Acceptance</u>: This criterion considers whether the state agrees with EPA's analyses and recommendations of the RI/FS and the Interim ROD.

MDNR generally supports the Selected Remedy (Alternative 2). Typically, MDNR has approved this same type of work in removal and remedial actions at this and other sites throughout Missouri. MDNR does not believe that Alternative 3 provides adequate protection of human health as stated in the March 28, 2008, letter, which is included in the AR. MDNR has indicated that a formal state concurrence letter will come in the near future.

9. <u>Community Acceptance</u>: This criterion considers whether the local community agrees with EPA's analyses and Preferred Alternative from the Proposed Plan. Comments received on the Proposed Plan are important indicators of community acceptance.

In general, the local community, including local citizens and officials, support the Selected Remedy (generally presented in the Proposed Plan as the Preferred Alternative). A Responsiveness Summary, which captures public comments has been included as part of the Interim ROD. The landowners of the Conrad tailings pile are willing to allow EPA to use their property as a soil repository.

PRINCIPLE THREAT WASTES

According to the Office of Solid Waste and Emergency Response's (OSWER) Directive 9380.3-06FS (A Guide to Principal Threat and Low Level Threat Wastes) dated November 1991, "Principle threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur." Based on this definition, contaminated residential soil does not appear to be a principal threat waste because it is not a source material. The mine waste at the Site is the ultimate source of the lead contamination in residential soil and will be addressed later under other RODs. Additionally, the remaining lead-contaminated residential surface soil is neither highly toxic nor highly mobile in part because of previous removal actions. This Interim ROD allows EPA to address the highest priority at the Site—human health risk posed by residential property surface soil—while additional evaluations are performed at other subsites on source materials.

SELECTED REMEDY

Summary of the Rationale for the Selected Remedy

The Selected Remedy is Alternative 2—Excavation, Disposal, Vegetative Cover, and Institutional Controls. The Selected Remedy was chosen over the other alternatives by EPA because, among other reasons, it will achieve the RAO and provides the best balance of trade-offs with respect to the nine NCP criteria. Alternative 2 is a continuation of the previous removal actions to excavate and replace lead-contaminated residential surface soil at the Site. Of the two alternatives which meet the threshold criteria, Alternative 2 is the better of the two active alternatives with respect to long-term effectiveness and permanence because phosphate treatment's effectiveness is unknown due to the lack of a long-term study and the degree to which residual lead contamination, even though lower in bioavailability, would be accepted by homeowners and health officials. Alternative 2 is also better with respect to short-term effectiveness because soil disturbance activities will take less time at each property and placing phosphate treatment materials on properties would need controls to protect residents and pets. It is also better with respect to implementability because the remedy will be completed sooner. With respect to cost, Alternative 2 is similar in cost to Alternative 3. Additionally, at other lead-mining Superfund sites, EPA has met this RAO by employing alternatives similar to Alternative 2 with respect to the key components. Finally, the ICs pilot project will help EPA develop workable and successful ICs with community input and government stakeholders for the final ROD for OU-3. Ultimately, ICs are needed by EPA to ensure that any physicals barriers placed at depth are not disturbed for long-term protection of human health. The pilot project will also help the local community and government officials evaluate ways to safeguard future residential development.

The HHRA, which is the basis for the RAO, clearly supports the need to take action at these high priority areas (residential properties) as soon as possible. Thus, it is important not to delay the remedial action to address other issues, such as selecting ICs with community input, addressing the LSFR subsite, etc. Due to the large number of residential properties requiring remediation, four years may be required to implement the Selected Remedy. Additional information will be collected during the ICs pilot project for consideration in the final remedy for OU-3. Final remedy selection for OU-3, and in particular the selection of ICs, will probably occur during implementation of this remedial action. This schedule enables EPA to address the highest priority at the Site, which is human health risk posed by lead-contaminated residential property surface soil.

Description of the Selected Remedy

Alternative 2: Excavation, Disposal, Vegetative Cover, and Institutional Controls
Estimated Total Capital Cost: $24.4 million
Estimated Annual O&M Cost Range: $0
Estimated Present Worth Cost: $22.4 million
Estimated Construction Time Frame: 4 years
Estimated Time to Achieve RAO: 4 years

Under this alternative, residential properties with at least one quadrant surface soil sample testing greater than 400 ppm for lead will have that quadrant and possibly drip zones remediated. The drip zone would be remediated if the composite lead concentration in the drip zone is greater than 400 ppm. Residential properties where no quadrant samples exceed 400 ppm lead would not be addressed under this action. Under this alternative, approximately 1,100 residential properties contain or are expected to contain lead surface soil concentrations greater than 400 ppm and will require remediation.

Approximately 800 residential properties in Madison County have not had their surface soil sampled by EPA. Under this alternative, EPA will continue to seek access to and sample all residential properties within Madison County to determine if they have been impacted by mining-related activities. If a surface soil sample in a property's quadrant has a lead concentration greater than 400 ppm, the property will be included in the remedial action.

Excavation: This alternative includes the excavation and removal of lead-contaminated surface soil, backfilling the excavation with clean soil, and seeding. Excavation of a residential property would be triggered when the highest recorded surface soil sample for any defined area of the property contains greater than 400 ppm lead. Soil would be excavated using limited size and lightweight excavation equipment and hand tools in the portions of the property where the surface soil exceeds 400 ppm lead. Excavation will continue in depth until the underlying soil at the bottom of the excavation is less than 400 ppm lead or to a maximum depth of 12 inches bgs, whichever is less. An exception is garden areas, where the maximum depth of excavation will be 24 inches bgs.

If at 12 inches bgs the lead soil concentration is greater than 1,200 ppm, EPA will excavate deeper if EPA determines that by excavating further a lead concentration of less than 1,200 ppm can be achieved. If EPA determines this cannot be achieved by excavating down further, EPA will place a barrier at 12 inches bgs. The barrier placed will be an obvious plastic barrier (such as an orange-mesh plastic sheet) that is permeable, wide meshed, and will not affect soil hydrology or vegetation. The physical barrier will function as a warning that digging lower will result in exposure to soil contaminated at a level that EPA has determined to be a human health concern. EPA recommends a minimum of 12 inches of clean soil be used as an adequate soil barrier from soil contaminated above the cleanup level for the protection of human health. The rationale for establishing a minimum clean soil thickness of 12 inches is that the top 12 inches of soil is considered available for direct human contact. Clean fill and topsoil would be used to replace soil removed after excavation, returning the residential property to its original elevation, grade, and potential. Clean fill and topsoil means, at a minimum, containing a lead level less than 240 ppm.

As indicated earlier, EPA estimates that 1,100 homes have been or will be discovered to have lead concentrations in surface soil greater than 400 ppm. Based on EPA's previous soil removal activities in and around Fredericktown, an average residential property will require removal and replacement of 186 yd^3 of soil. Therefore, an estimated total of approximately 204,600 yd^3 of soil would require excavation, disposal, and replacement. This estimated total is used as the basis for part of the cost estimate for this remedial action.

Disposal: The excavated soil will be disposed at the Conrad tailings pile. The Missouri Department of Transportation has previously used the Conrad tailings pile for disposal of excavated lead-contaminated soil. The capacity of the projected Conrad repository has not been determined but will be determined during the Remedial Design (RD). For contaminated soil which would fail the TCLP analysis, a lead stabilization compound will be added to the soil at the repository until the soil meets the TCLP maximum concentration for lead. Regulatory requirements for disposal of the soil at the repository will be followed.

Revegetation: After the topsoil has been replaced, the property would be hydroseeded to restore the vegetation. Hydroseeding is preferred over sodding for its ease of initial maintenance and significant cost reduction. However, sod may be used in areas of properties with steep slopes that would be subject to erosion before the vegetation could become established.

<u>Institutional Controls:</u> Due to the environmental problems of lead and other metals in Madison County, health education will be needed to help reduce exposures that could potentially lead to adverse health effects. An active educational program would be conducted in cooperation with EPA, ATSDR, MDNR, MDHSS, and the Madison County Health Department. The education activities would primarily be conducted by the Madison County Health Department. The following, although not an exhaustive list, indicates the types of education activities that may be conducted at the Site.

- Conducting extensive community-wide blood lead monitoring
- Performing in-home assessments for children identified with elevated blood lead levels
- Distributing of exposure prevention information and literature
- Holding meetings with and acting as a resource for area physicians of local families
- Providing community education through meetings; literature; talks and presentations at civic clubs, schools, nurseries, pre-schools, churches, fairs, etc.; and one-on-one family assistance
- Undertaking special projects to increase awareness of how local citizens can protect themselves from heavy metal health risks
- Working with construction workers, developers, residents, and local and county officials towards effective ICs to protect barriers and lead-contaminated soil at depth and ensure safe future development

With regard to the physical barriers that have been and may be put down at depth in residential properties during the previous removal actions and the upcoming remedial action, respectively, EPA will need to ensure that the barriers and the soil below them are not disturbed for long-term protection of human health. Typically, EPA has looked to various types of ICs to ensure the remedy's long-term protectiveness. While EPA is considering proprietary controls such as restrictive covenants, these controls present a great difficulty at this Site given the large number of residential properties in Madison County that may be covered by the remedy. However, EPA will continue to evaluate the feasibility of these controls as the remedial action selected in the Interim ROD is being implemented. Additionally, EPA has already spoken with the repository landowner about a restrictive covenant to protect the potential repository.

Governmental controls, such as an ordinance requiring permits for earthmoving activities and restricting soil use in areas of known heavy metal contamination at depth would be an efficient and effective control measure. EPA has begun discussions with the Madison County Health Department at periodic roundtable meetings and the public meeting for the Proposed Plan, as well as previous phone conversations. Further discussion, collaboration, and evaluation with the state of Missouri, Madison County Health Department, and other local departments regarding governmental controls will continue.

Because EPA is still evaluating the most effective type or types of ICs for residential properties at the Site, the final measures for either or both proprietary and governmental controls will be worked out and described in more detail in the final FS, Proposed Plan, and final ROD for OU-3. However, as part of this Interim ROD, EPA will pilot an ICs project with MDNR and the Madison County Health Department that would include local governmental controls. Some of these controls would address protection of any physical barriers laid down at depth at residential properties during the upcoming remedial action. However, it could also include building permits for potentially mining-contaminated properties, administrative listing for the county to restrict digging at contaminated properties, builder and developer education when dealing with heavy metal soil contamination, and best management practices for construction work undertaken at potentially mining-contaminated properties. The pilot project may be modeled after the Bunker Hill Superfund Site Institutional Controls Program and could be extended up to three years for completion.

Summary of the Estimated Remedy Costs

The present worth cost for Alternative 2 is estimated to be $22.4 million and is presented in Table 9. The capital costs are spread over a construction period of four years. A 3.5% discount rate was used to calculate the present worth. A present worth analysis was performed to evaluate project costs over four years and is included in the table. This estimate is approximate and made without detailed engineering data. The information in Table 9 is based on the best available information regarding the anticipated scope of the Selected Remedy. Changes in the cost elements are likely to occur as a result of new information and data collected during the implementation of the remedial action. Major changes, if they arise, may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Differences, or an amendment to this Interim ROD. This is an order-of-magnitude engineering cost estimate that is expected to be accurate within +50 to -30 percent of the actual project cost.

Expected Outcomes of the Selected Remedy

The Selected Remedy will provide an accelerated response to residential property surface soil contaminated with lead above the cleanup level and will significantly improve human health protection in the community. The cleanup level of 400 ppm lead in surface soil is based on the HHRA and RAO. The Selected Remedy will take an estimated four years to implement due to the large number of properties involved. The interim strategy allows for further assessment of the other part of OU-3, the LSFR subsite, while exposure to lead in surface soil at residential properties, which pose the highest human health risks, are remediated through the well-demonstrated approach of excavation and soil replacement. The Selected Remedy at properties where barriers are placed at depth will ultimately be protected by IC development as selected in the final ROD for OU-3 and evaluated under this Interim ROD during the ICs pilot project.

Regarding future land use of the remediated residential properties, continued residential use is anticipated. With adequate IC development, the land use will actually be enhanced because lead-contaminated surface soil that would pose a human health risk will be excavated from the large majority of residential properties. For residential properties where a physical barrier will be placed at depth and an IC put in place to protect the barrier, the upper 12 inches of soil at least would be available for direct human contact under this alternative.

STATUTORY DETERMINATIONS

EPA expects the Selected Remedy to satisfy the following statutory requirement of Section 121(b) of CERCLA: (1) be protective of human health and the environment, (2) comply with ARARs, (3) be cost-effective, (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable, and

(5) satisfy the preference for treatment as a principal element or explain why the preference for treatment will not be met. The following sections discuss how the Selected Remedy meets these statutory requirements.

Protection of Human Health and the Environment

The Selected Remedy will protect human health and the environment at remediated residential properties by achieving the RAO through a well-demonstrated approach using conventional engineering measures. Risks associated with lead-contaminated residential soil at the Site are caused by the potential for direct contact with contaminated surface soil. The Selected Remedy eliminates this direct exposure pathway through excavation and replacement of lead-contaminated surface soil at the residential properties. Contaminated surface soil will be removed from residential properties, up to a depth of 24 inches bgs. The implementation of the Selected Remedy will not pose unacceptable short-term risks or cross-media impacts.

Compliance with ARARs

The Selected Remedy is expected to meet all chemical-specific, action-specific, and location-specific ARARs and does not involve any waivers. Because there are many ARARs, the ARARs for this Interim ROD are included in Tables 3 through 8. Additionally, EPA and MDNR have determined there are a number of documents that should be considered since they help to ensure protectiveness or are appropriate for use with regard to the Selected Remedy. Such non-binding criteria are commonly referred to as To Be Considereds (TBCs). TBCs are included in Tables 3 through 8.

Cost Effectiveness

The Selected Remedy is a cost-effective solution to lead-contaminated residential surface soil at the Site. The cost difference between the Selected Remedy (Alternative 2) at approximately $24.4 million and the other alternative that meets the threshold criteria (Alternative 3) at approximately $23.7 million is less than 3%. Additionally, the effectiveness of a large part of Alternative 3 depends on a successful treatability study indicating that phosphate stabilization provides permanence and long-term protectiveness. The excavation and replacement of contaminated surface soil in the Selected Remedy has the highest level of short- and long-term effectiveness and permanence of the alternatives evaluated. No treatment technologies were identified that could demonstrate short- or long-term effectiveness and permanence for remediation of residential surface soil at this time. Although not achieved through treatment, the Selected Remedy does result in reduced mobility of site contaminants through engineering controls. The Selected Remedy relies on conventional engineering methods that are easily implemented. Contaminated surface soil is removed and replaced, thereby providing a permanent remedy for remediated residential surface soil which will not be subject to future costs.

Utilization of Permanent Solutions and Alternate Treatment Technologies to the Maximum Extent Practicable

The Selected Remedy utilizes a well-demonstrated remediation approach to lead-contaminated surface soil that will provide a permanent remedy for residential soil. Removal and replacement of contaminated residential surface soil permanently removes heavy metal contaminants as a potential source of exposure to residents and children in particular. For a subset of excavated contaminated residential soil, lead stabilization treatment is needed to prevent the soil from failing TCLP. However, the volume of this soil is not expected to be a significant portion of the excavated residential soil. No treatment technologies were identified that could be considered reliable at this time. The ICs pilot project which will result in final ICs in the final ROD and health education will add to the long-term effectiveness for this Site.

Preference for Treatment

The Selected Remedy does not utilize treatment to address the risks posed by the residential property surface soil. No treatment technologies were identified that have definitively demonstrated the ability to reliably provide short- and long-term effectiveness, permanence, and meet the other NCP criteria. For a subset of excavated contaminated residential soil, lead stabilization treatment is needed to prevent the soil from failing TCLP. However, the volume of this soil is not expected to be a significant portion of the excavated residential soil.

Based upon the information currently available, the EPA believes the Selected Remedy meets the threshold criteria and provides the best balance of trade-offs among the other alternatives with respect to the balancing and modifying criteria. The EPA concludes that the Selected Remedy satisfies the following statutory requirement of Section 121(b) of CERCLA: (1) be protective of human health and the environment, (2) comply with ARARs, (3) be cost-effective, (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable, and (5) satisfy the preference for treatment as a principal element or explain why the preference for treatment will not be met.

Five-Year Review Requirements

At remediated residential properties where no physical barriers are placed at depth, the Selected Remedy does not result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure. However, at properties where barriers are placed at depth, lead is left on-site at levels that do not allow unlimited use and unrestricted exposure. Additionally, the consolidation of the lead-contaminated residential soil on the Conrad tailings pile and potentially other repositories means that contamination will be left at the Site. Therefore, the selected remedy is subject to periodic five-year reviews in accordance with Section 121(c) of CERCLA and the NCP at 40 C.F.R. § 300.430(f)(5)(iii)(C).

DOCUMENTATION OF SIGNIFICANT CHANGES

Several changes have been made in this Interim ROD with respect to the Proposed Plan. The first is if EPA will excavate deeper if lead concentrations at 12 inches bgs remain elevated and what lead concentration at 12 inches will require further excavation. The Proposed Plan indicated that if the lead concentration in soil at 12 inches bgs remained above 400 ppm, EPA **may** choose to dig to 18 inches bgs before deciding if a barrier at depth is needed. The Interim ROD states that if at 12 inches bgs the lead concentration is above 1,200 ppm, EPA **will** excavate to 24 inches bgs if it can be determined that a lead concentration of less than 1,200 ppm can be achieved.. Otherwise, a barrier will be placed at 12 inches bgs. This change is because of EPA's goal to leave as many properties as feasible available for unlimited use and unrestricted exposure as well as a letter by ATSDR supporting these conditions, which is included in the AR.

The last change relates to the time allowed for the ICs pilot project. Whereas the Proposed Plan indicated the pilot project would run only one year, the Interim ROD allows EPA to extend the pilot project up to three years or the finish of the pilot project. This allows EPA to continue working with interested citizens and local, county, state, and other federal government officials to develop ICs that satisfy the nine criteria, including acceptance by the community.

GLOSSARY OF TERMS

This glossary defines many of the technical terms used in relation to the Madison County Mines Site in this Interim ROD. The terms and abbreviations contained in this glossary are often defined in the context of hazardous waste management and apply specifically to work performed under the Superfund program. Therefore, these terms may have other meanings when used in a different context.

Administrative Record (AR): All documents which EPA considers or relies upon in selecting the response action at a Superfund site, culminating in the Record of Decision for remedial action.

Baseline Human Health Risk Assessment (HHRA): A document that provides an evaluation of the potential threat to human health in the absence of any remedial action.

Bioavailability: A risk assessment term; the fraction of an ingested dose that crosses the gastrointestinal epithelium in the stomach and becomes available for distribution to internal target tissues and organs.

Blood lead level or concentration: The concentration of lead in the blood, measured in micrograms of lead per deciliter of blood (μg/dL).

Capital Cost: Direct (construction) and indirect (nonconstruction and overhead) costs including expenditures for equipment, labor, and materials necessary to implement remedial actions.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act. The acts created a special tax that went into the Trust Fund, commonly known as Superfund, to investigate and clean up abandoned or uncontrolled hazardous waste sites. Under the program, EPA can either; (1) pay for site cleanup when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work, or (2) take legal action to force parties responsible for site contamination to clean up the site or pay back the federal government the cost of the cleanup.

Contaminant: Any physical, chemical, biological, or radiological substance or matter that can have an adverse effect on human health or environmental receptors.

Contaminant of Concern (COC): A substance detected at a hazardous waste site that has the potential to affect receptors adversely due to its concentration, distribution, and mode of toxicity.

Discount rate: A percentage rate used in present worth analyses to identify the cost of capital and operation and maintenance expenses. It is used to value a project using the concepts of the time-value of money where future cash flows are estimated and discounted to give them a present value.

Dolomite: A sedimentary rock containing greater than 50% of the mineral dolomite; often found with calcite in forming limestone, another sedimentary rock.

Expanded Site Inspection (ESI): A field investigation that typically follows a preliminary assessment and is designed to collect more extensive information on a hazardous waste site. The information is used to score a site using the Hazardous Ranking System to determine whether a response action is needed.

Exposure pathways: The course a chemical or physical agent takes from a source to an exposed organism. Each exposure pathway includes a source or release from a source, an exposure point, and an exposure route.

Feasibility Study (FS): A report that analyzes the practicability of potential remedial actions; i.e., a description and analysis of potential cleanup alternatives for a site on the National Priorities List.

Groundwater: Water filling spaces between soil, sand, rock and gravel particles beneath the earth's surface, which often serves as a source of drinking water.

Interim: Temporary or provisional; as used in the Proposed Plan, efforts that address a portion of the Madison County Mines Site on a temporary basis until the final remedy for the entire operable unit is implemented.

National Contingency Plan (NCP): The federal regulation that guides the Superfund program.

National Priorities List: EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial action under Superfund. The list is based primarily on the score a site receives from the Hazard Ranking System.

Operation and Maintenance (O&M): Activities conducted at a site after response actions occur to ensure that the cleanup or containment system continues to be effective.

Present worth: The amount of money necessary to secure the promise of future payment or series of payments at an assumed interest rate.

Proposed Plan: A plan for a site cleanup that is available to the public for comment which summarizes remedy alternatives and presents EPA's Preferred Alternative or cleanup approach.

Quadrant sample: A composite surface soil sample collected from a portion (usually one quarter) of a residential property.

Record of Decision (ROD): A public document that explains which cleanup alternative(s) will be used at a National Priorities List site.

Remedial action: The actual construction or implementation phase of a Superfund site cleanup.

Remedial Investigation (RI): An in-depth study designed to gather data needed to determine the nature and extent of contamination at a Superfund site, establish site cleanup criteria, identify preliminary alternatives for remedial action, and support technical and cost analyses of alternatives. The remedial investigation is usually done with the feasibility study. Together they are usually referred to as the RI/FS.

Removal action: Short-term immediate actions taken to address releases of hazardous substances that require an expedited response.

Responsiveness Summary: A summary of oral and/or written public comments received by EPA during a comment period on key EPA documents and EPA's response to those comments.

Salem Plateau: A dissected karst plain located in south central Missouri and northern Arkansas consisting of rolling uplands and rugged hills with deeply entrenched stream valleys and ranges between about 1,000 feet to 1,400 feet in elevation. There are abundant sinkholes, caves, springs, and losing streams.

Toxicity: The degree to which a chemical substance (or physical agent) elicits a deleterious or adverse effect upon the biological system of an organism exposed to the substance over a designated time period.

RESPONSIVENESS SUMMARY FOR THE INTERIM RECORD OF DECISION
Residential Property Surface Soil (Part of OU-3)
Madison County Mines Superfund Site
Madison County, Missouri

This Responsiveness Summary has been prepared in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and the National Contingency Plan (NCP), 40 C.F.R § 300.430(f). This document provides the United States Environmental Protection Agency's (EPA's) response to all significant comments received from the public on the Proposed Plan for the residential properties portion of the Madison County Mines Superfund Site (Site) during the 30-day comment period.

The Responsiveness Summary consists of the following three components: an overview of the public process, responses to verbal questions received at the public meeting, and responses to written correspondence received during the public comment period. This document is provided to accompany the Interim Record of Decision (ROD) and reflects input resulting from the public comment process.

Overview

The Proposed Plan and supporting documents included in the Administrative Record (AR) file were made available for public review and comment for 30 days from April 16 to May 15, 2008. There are no known potentially responsible parties. A public meeting was held at the Site at the Black River Electric Cooperative in Fredericktown, Missouri, on April 29, 2008, with 13 local officials and citizens in attendance. The transcript from the public meeting is included in the AR.

One letter was received during the 30-day public comment period. Submitted by the Missouri Department of Health and Senior Services (MDHSS), the letter generally supports the Preferred Alternative in the Proposed Plan but suggests a few changes. Additionally, the Missouri Department of Natural Resources (MDNR) submitted a letter on the Proposed Plan prior to its release suggesting several changes. Changes identified in both documents were evaluated by EPA and many were incorporated into the Proposed Plan. These letters have been added to the AR.

Responses to Verbal Comments

Several questions were asked at the public meeting following EPA's formal presentation. Since each individual may have asked multiple questions, the questions and associated responses are grouped by the individual posing the question. This summary provides generalized designations or affiliations for individuals asking questions. The detailed transcript of the public meeting has been added to the AR for the Site.

Questions from the landowner of the Conrad tailings pile – The landowner questioned the timing of the cleanup, both for her residential yard and her tailings pile upon which EPA plans to place the excavated contaminated residential soil. She also pointed out that the recent extended heavy rainfall had affected the road built to the tailings pile. Finally, the landowner asked how funding for Superfund remedial actions or cleanups works.

Response to the Conrad tailings pile landowner – Once the Interim ROD is finished and depending on the availability of funds, EPA would prefer to begin this cleanup in the fall of 2008. EPA would like to address all the residential properties requiring remediation at the Site within four years. Additionally, as part of the work, erosion controls and stabilization of the Conrad tailings pile would occur. Specifically, the road to the tailings pile would be repaired if needed to provide the cleanup contractor a stable road for access.

Regarding the availability of funds (money) for Superfund remedial actions, Superfund sites across the country needing funds to start a cleanup compete annually for the fixed amount of funds available for new remedial action construction starts. After starting a remedial action at a site, EPA requests funds every year to continue the cleanup, although there are limitations on how much will be given to a specific site among the many sites requiring funds. For this Site, EPA has already gone through the funding competition for the residential soil remedial action and did fairly well. The Region has been promised funds to start this cleanup in the fall. In conclusion, it is EPA's intention to start the residential property cleanups and stabilization of the Conrad tailings pile as soon as possible. Regarding stabilizing the Conrad tailings pile, EPA will set up temporary erosion controls to maintain contaminated soil disposed of at the repository while EPA and MDNR agree on a final, more thorough approach to controlling storm water and erosion. This final approach will be implemented at the Conrad tailings pile as soon as it is available.

Questions from the Associate County Commissioner – The Associate Commissioner asked what was meant by the phrase "above average or elevated blood lead level" for children. He also asked for an explanation of EPA's health protection goal for lead and children. The Associate Commissioner asked why EPA proposed the Preferred Alternative, which includes excavation, removal, and replacement of lead-contaminated soil, over the in situ phosphate stabilization alternative. He also asked what the cost for previous residential soil cleanups in the county was and if the approximately 1,100 residential properties expected to need the cleanup were unremediated. Additionally, the Associate Commissioner asked if EPA had the most up-to-date equipment to test residential soil. Finally, he asked why EPA sometimes digs deeper at some residential properties.

Responses to the Associate County Commissioner – The average percentage of children across the country who have elevated blood lead levels or blood lead levels above 10 micrograms per deciliter (μg/dL) is currently below 2%. In the past, as the County Health Administrator confirmed during the public meeting, the percentage of Madison County children who had elevated blood lead levels was higher than 2%. For instance in 2001, 13% of Madison County children less than 6 years old who were tested had elevated blood lead levels. In 2006, 1.98% of children in Madison County tested had elevated blood lead levels.

As stated in the presentation at the public meeting, EPA's health protection goal for lead in children is that there should be no more than a 5% chance that a child or group of similarly exposed children will have a blood lead level exceeding 10 μg/dL. This health protection goal has two components: the 10 μg/dL blood lead level part and the less than 5% chance part. For the first, blood lead levels can be correlated with both exposure and adverse health effects. Since the toxicokinetics (movements of toxins into, through, and out of the body) of lead are well understood, lead health impacts are based on blood lead levels. As a result of many studies, EPA and the Centers for Disease Control and Prevention (CDC) have determined that child blood lead levels at or above 10 μg/dL present risks to children's health. The basis for the second part of the health protection goal—no more than a 5% chance—is analyses conducted by the CDC and EPA which demonstrate adverse health effects in children at or below a blood lead level of 10 μg/dL. In contrast, EPA's health protection goal does **not** mean that it is acceptable for 5% of children at the Site to have blood lead levels exceeding 10 μg/dL. The goal is focused on the probability of an **individual child** or group of similarly exposed children exceeding a blood lead level of 10 μg/dL.

Regarding excavation, removal, and replacement of lead-contaminated residential soil over in situ phosphate stabilization or treatment, EPA prefers the former cleanup approach for several reasons. First, in situ phosphate stabilization has never been shown to remediate high levels of lead in soil to the cleanup goal of 400 ppm. The goal of the phosphate stabilization is to reduce the bioavailability of the lead in soil so that if the soil is ingested, less lead is absorbed by the body than if the soil was not treated. This EPA region has studied and tested this treatment more than any other in the country. Through various studies, EPA has found that the treatment of lead-contaminated soil results in a maximum decrease of 40% of bioavailability of lead in soil. A 40% bioavailability decrease only addresses lower lead soil levels, such as 800 parts per million (ppm) or less. Thus, phosphate stabilization would address lead-contaminated soil with lower levels, which is only part of the problem. Second, phosphate stabilization treatment requires several years to implement. Several steps must be taken before the treatment can be applied at a site on a full-scale. These steps include conducting a bioavailability study using actual Site soil; applying the treatment at a few test areas at the Site; receiving state, county, and local input on the study; and deciding on the best application methods. Additionally, after the treatment was completed, it would be difficult and expensive to confirm that the bioavailability of lead in the treated soil would remain reduced over time. As expressed by other stakeholders at other lead-mining Superfund sites, there are concerns about the lead being left in the soil after the treatment. In future testing it would be very difficult to determine if the lead in the residential soil was previously treated with phosphate, or if it had been recently brought to the property as mine waste fill. Third, there are some issues with implementing phosphate stabilization. Phosphoric acid with a very low pH (which can burn people pets, or wildlife) must be rototilled into the soil and remain undisturbed for 7 to 10 days, after which lime is rototilled into the soil to raise the pH. During this 7- to 10-day time frame, the yard would need to be fenced off to prevent people and animals from walking on the soil and protect them from getting burned by the rototilled phosphoric acid.

Furthermore, transporting and applying the viscous phosphoric acid would be difficult in the large quantities needed for the large number of properties requiring remediation at the Site. Fourth, a recent study at the Omaha Lead Site found that the cost of effectively implementing phosphate stabilization was similar to the cost of excavation, removal, and replacement of residential soil. Finally, EPA has performed many excavations, removals, and replacements at this Site and other lead-mining Superfund sites and therefore is experienced in performing cleanups.

Regarding the cost of the previous residential property cleanups, EPA estimates that approximately $11 million was spent at the Site. None of the residences previously cleaned up are included in the future cleanup of approximately 1,100 residences. During previous removal cleanup actions, a residential property's soil was cleaned up to 400 ppm for lead, which is the cleanup goal set for residential surface soil in the Interim ROD.

EPA has recently purchased new portable x-ray fluorescence analyzers (XRFs), which are the instruments that EPA routinely uses to analyze lead and other metals in soil in the field. These XRFs are the most up-to-date models available and will be used in the future at the Site. However, there is nothing wrong with the older instruments EPA used and their results are valid.

Digging deeper at a residential property allows EPA to leave as many residential properties as possible available for unrestricted exposure and unlimited use. During previous removal cleanup actions, EPA would sometimes dig deeper in areas where the soil level was above 400 ppm or where mine waste was visible. Sometimes septic tanks, utility lines, large tree roots, etc. limit how deep EPA can effectively dig. Overall, the cleanup goal of 400 ppm lead in residential soil will be met by excavation, removal, and replacement.

<u>Question from landowner</u> – The landowner asked about the inclusion of two of his properties, both of which are abandoned schools, in the State of Missouri's Voluntary Cleanup Program. He would like to address the run-down buildings on these properties as well as on-site soil contaminated with heavy metals. However, since the properties are within a Superfund site, he wanted some clarification on how to move forward on cleaning up the properties.

<u>Response to landowner</u> – A Memorandum of Agreement dated September 5, 1996, between MDNR and EPA states that a property within a Superfund site cannot enter the state's Voluntary Cleanup Program if the property is contaminated with the same hazardous substances for which the site is in the Superfund program. In this specific instance, the soil around the schools is contaminated with lead, one of the main reasons the Site became a Superfund site. Therefore, these properties cannot be included in the Voluntary Cleanup Program. However, the buildings can be removed from the properties at any time as long as removal of the building does not cause further releases into the environment. Excavation of soil contaminated with heavy metals would not be allowed under the state's Voluntary Cleanup Program since these contaminants are the main reason Madison County became a Superfund site. Additionally, it is EPA's understanding that MDNR is working on a suitable legal instrument to allow the landowner to enter into a State Cooperative Agreement to address the landowner's concerns.

Responses to Written Correspondence

Letter from MDNR dated March 28, 2008 – This letter includes comments on the Remedial Investigation and Focused Feasibility (FS) Study reports completed in April 2008. However, because some of the comments are applicable to the Proposed Plan, EPA has paraphrased comments that affected the Proposed Plan and responded below.

Comment – The first comment suggested a more targeted approach to data collection of blood lead levels, focusing specifically on gender and ethnic differences.

Response – EPA subsidizes health education through various federal, state, and county government health agencies and departments at lead-mining Superfund sites. At these sites, including the Site, health education often includes blood lead level testing. However, EPA has no authority to require or direct the health agencies to test by specific ratios or specific groups of people. EPA is interested in the health of **all** individuals at a Superfund site. However, with respect to lead, EPA remains very focused on sensitive subpopulations, including children, the elderly, and pregnant women.

Comment – The second comment requested broadening and improving select human exposure scenarios, including All Terrain Vehicle (ATV) riders; hikers and bicyclers; swimmers and waders; and collectors and growers of fruits and vegetables.

Response – EPA conducted a thorough Human Health Risk Assessment dated July 2007, which is included in the AR for public review. In this assessment, EPA evaluated several scenarios of children and adults including residents, commercial workers, recreational visitors, and recreational visitors to area streams and ponds. This includes ATV riders, swimmers and hikers. Overall, the assessment includes exposure scenarios for groups thought to be at the highest risk.

Comment – The next comment cited MDNR's concerns about using the Conrad tailings pile as a repository for the excavated residential soil. In particular, current erosion of some of the edges of the pile as well as uncontrolled runoff during rain events were of concern. Additionally, MDNR recommends including runoff and erosion control in the cost estimates in the Focused FS.

Response – EPA understands and shares MDNR's concern about erosion and runoff issues at the Conrad tailings pile. As a result, EPA and MDNR conducted a site walk over the Conrad tailings pile on April 29, 2008. It was generally agreed that the back or northeastern portion of the pile is currently stable enough to receive excavated residential soil during the fall 2008 construction season with some minor on-site reworking, such as a berm around the projected excavated soil pile. Additionally, EPA will work with MDNR to engineer permanent erosion and runoff controls for the Conrad tailings pile, which will most likely be ready for construction in spring 2009. Finally, EPA included construction of these erosion and runoff controls in its cost estimates in the Proposed Plan and the cost estimate for the Selected Remedy in this Interim ROD.

Comment – The next comment requested that the level of lead in the replacement or *clean soil* be specified and suggests defining the term using the Missouri Risk-Based Corrective Action level of 260 ppm for lead. Additionally, MDNR requested further information about any testing that will be conducted to confirm that the replacement soil has sufficiently low levels of lead.

Response – EPA has specified in the Interim ROD that 240 ppm will be the acceptable level of lead in replacement or "clean" soil. This level is consistent with previous removal cleanup actions and is lower than the level suggested by MDNR. EPA has not determined the level of testing that will be required to confirm lead levels in replacement soil or the methodology of testing. This will be further outlined in remedial design and contracting documents after this Interim ROD is issued. EPA will share this information with MDNR as the documents are developed. However, EPA will probably conduct similar testing and methodologies as those used during the previous removal cleanups. During the removal cleanups, EPA collected surface soil samples from potential backfill sources by dividing the area into a grid pattern with individual cell dimensions not to exceed 100 feet by 100 feet. EPA took multiple aliquot composite soil samples from the cells and submitted them for laboratory analysis for total metals. Additionally, EPA periodically tested the lead levels in the replacement soil with an XRF during the ongoing cleanup.

Comment – The next comment requested using a lowered discount rate of 3.25% instead of 7% in the cost estimates.

Response – EPA adjusted the discount rate to 3.5% in cost estimates in the Focused FS, Proposed Plan, and Interim ROD.

Comment – The next comment advised against the selection and implementation of Alternative 3, a combination of excavation and removal with in situ phosphate stabilization. MDNR stated that the alternative is expensive, unproven, and may risk unnecessary human health exposure to lead. MDNR also has questions about the timing for determining the success or failure of this alternative and whether more proven technologies would be delayed in the meantime. MDNR has a related concern of who would bear the cost if Alternative 3 failed.

Response – State acceptance is one of the nine criteria EPA must consider when selecting a remedy or cleanup approach at a Superfund site. EPA appreciates MDNR's concerns about the use of phosphate stabilization as part of Alternative 3. In this Interim ROD, the Selected Remedy is Alternative 2, which is excavation, removal, and replacement and does not include phosphate stabilization.

Comment – In the final comment, MDNR wanted to know if one quadrant at a residential property is greater than the 400 ppm lead cleanup level, if all additional quadrants at the property be considered for cleanup.

Response – Any surface soil in a quadrant at a residential property that tests greater than 400 ppm lead will be cleaned up. Only those quadrants containing surface soil lead levels greater than 400 ppm will be cleaned up under this Interim ROD. The drip zone at a residential property would be remediated only if the composite lead level in the drip zone is greater than

400 ppm and if another quadrant at the property needed cleanup. In contrast, residential properties where no quadrant samples exceed 400 ppm lead would not be addressed. Also, residential properties where only the drip zone has a surface soil level above 400 ppm lead will not be cleaned up. Generally, EPA will follow the "Superfund Lead Contaminated Residential Sites Handbook" as well as use cleanup methods and experience gained from previous cleanups at the Site.

Letter from MDHSS dated May 15, 2008 – This letter supported the Preferred Alternative outlined in the Proposed Plan. However, MDHSS requested several additions and clarifications be made to the Preferred Alternative. The comments are paraphrased below and EPA's responses are identified.

Comment – The first comment supported the excavation, removal and replacement of lead-contaminated soil as well as health education. The second comment requested that the level of lead in the replacement or "clean" soil be specified.

Response – EPA appreciates MDHSS' support of the Preferred Alternative. As mentioned earlier, EPA has included in the Interim ROD that 240 ppm is the level of lead acceptable in replacement or "clean" soil.

Comment – The third comment requests that appropriate quality assurance and quality control be done on soil samples analyzed in the field with the XRF, including 10% of these samples being submitted for analysis to a laboratory.

Response – EPA believes that it is more appropriate to outline the various detailed quality assurance and quality control procedures that will be applied to future sampling in other sampling-specific plans, such as a Quality Assurance Project Plan. In contrast, the Proposed Plan and Interim ROD are overarching decision documents which review key site information, compare and contrast various cleanup alternatives, and present EPA's Preferred Alternative in the Proposed Plan or Selected Remedy in this Interim ROD. However, in general, EPA will periodically collect confirmation soil samples at the beginning of the cleanup for laboratory analysis to confirm that the XRF is working correctly. Further details can be found in future quality assurance and quality control documents during the cleanup.

Comment – The fourth comment requests a rearrangement of certain paragraphs on pages 12 and 13 of the Proposed Plan regarding the Preferred Alternative for continuity purposes.

Response – As a result of the previous comment, EPA has attempted to make the description of the Selected Remedy, which was the Preferred Alternative, clearer and more continuous.

Comment – The fifth and final comment was related to the orange mesh barrier that EPA used for demonstration purposes at the public meeting on April 29, 2008, as a type of plastic barrier that could be placed at the bottom of excavations where the lead level is greater than 1,200 ppm. MDHSS stated that that particular plastic barrier would be insufficient to act as a physical barrier between contaminated and clean soil, that the barrier was an integral component of the remedy, and that the properties of the plastic barrier should be further specified.

Response – As stated in the Proposed Plan and MDHSS's letter, EPA will place "an obvious plastic barrier that is permeable, wide meshed, and will not affect soil hydrology or vegetation, such as an orange-mesh plastic sheet" at the bottom of excavations where the lead level is greater than 1,200 ppm. EPA believes that the plastic barrier shown at the public meeting fits this criteria very well. It is tough, resilient, bright, wide-meshed, and will not affect soil hydrology. In contrast, a plastic sheet with fewer and limited openings, such as orange snow fence, will definitely negatively impact soil hydrology or water drainage. Additionally, the goal of the plastic barrier is to alert anyone digging at that depth that there is contamination below the barrier. The plastic barrier is not intended to keep the contaminated soil separated from the overlying clean soil because that would require a barrier with no openings which would greatly affect soil hydrology and vegetation. Furthermore, at a depth of 24 inches below ground surface, EPA does not believe that the contaminated and clean soil will mix much. Finally, as stated earlier, the Proposed Plan and Interim ROD are overarching decision documents that summarize key elements of the Preferred Alternative and Selected Remedy. Specifying the properties of the plastic barrier is too specific of a detail to include in the Proposed Plan or Interim ROD. However, EPA will specify select plastic barrier properties as part of its solicitation for bids for the cleanup.

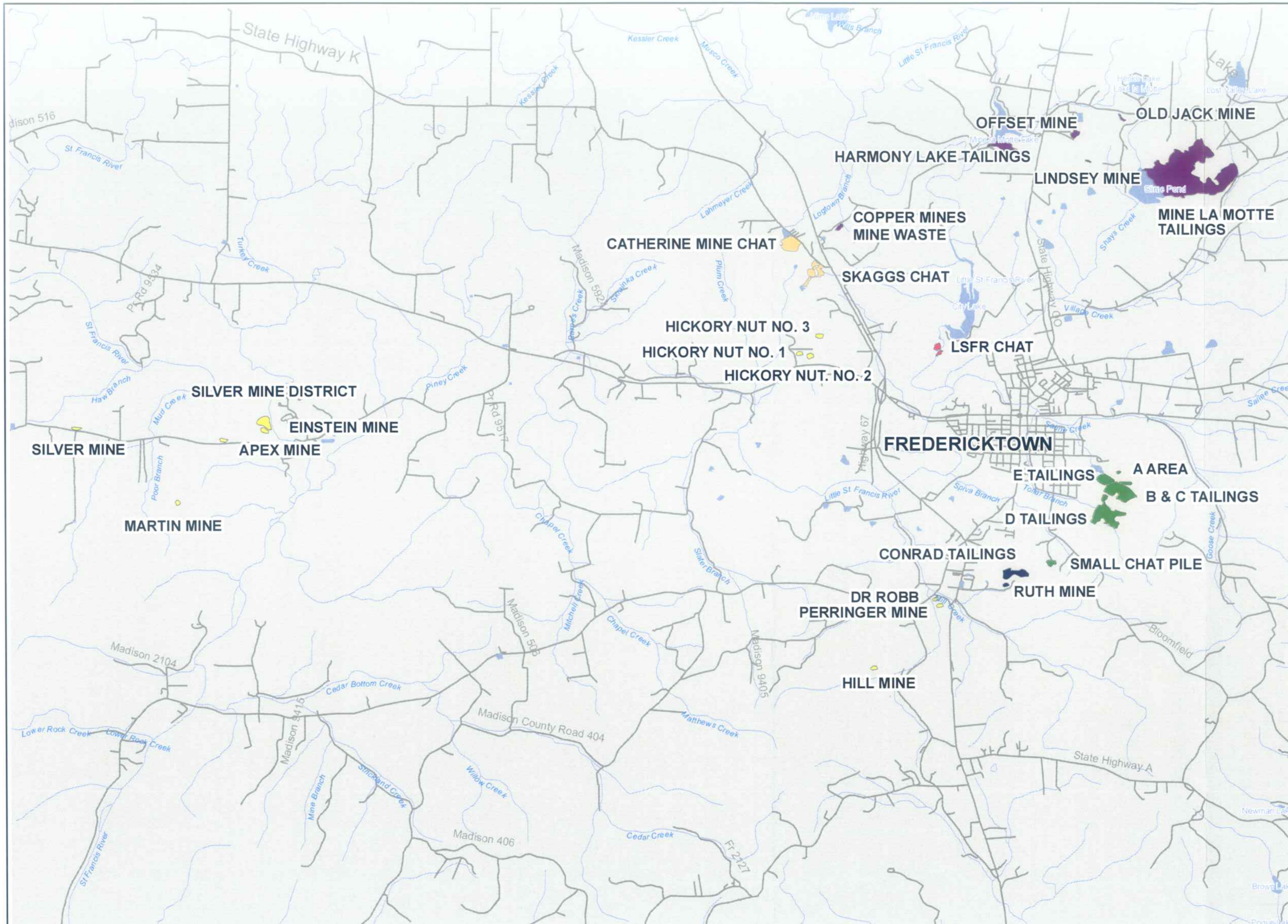
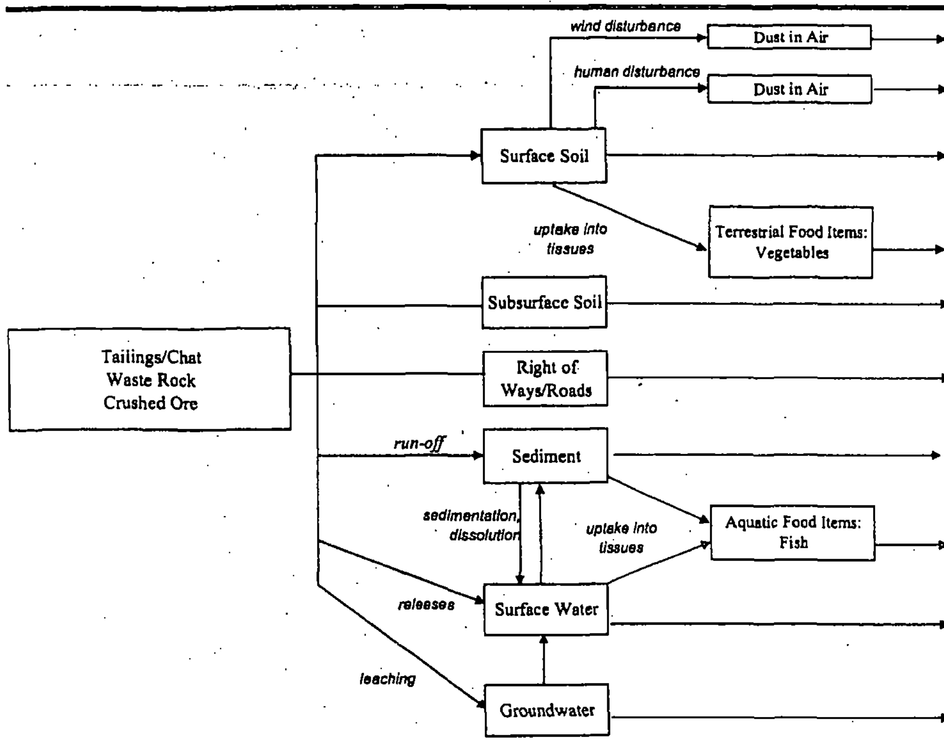


FIGURE 1:
SITE MAP

MADISON COUNTY MINES
FREDERICKTOWN, MISSOURI

Figure 2 Site Conceptual Model for Human Exposure at the Madison County Mines Site



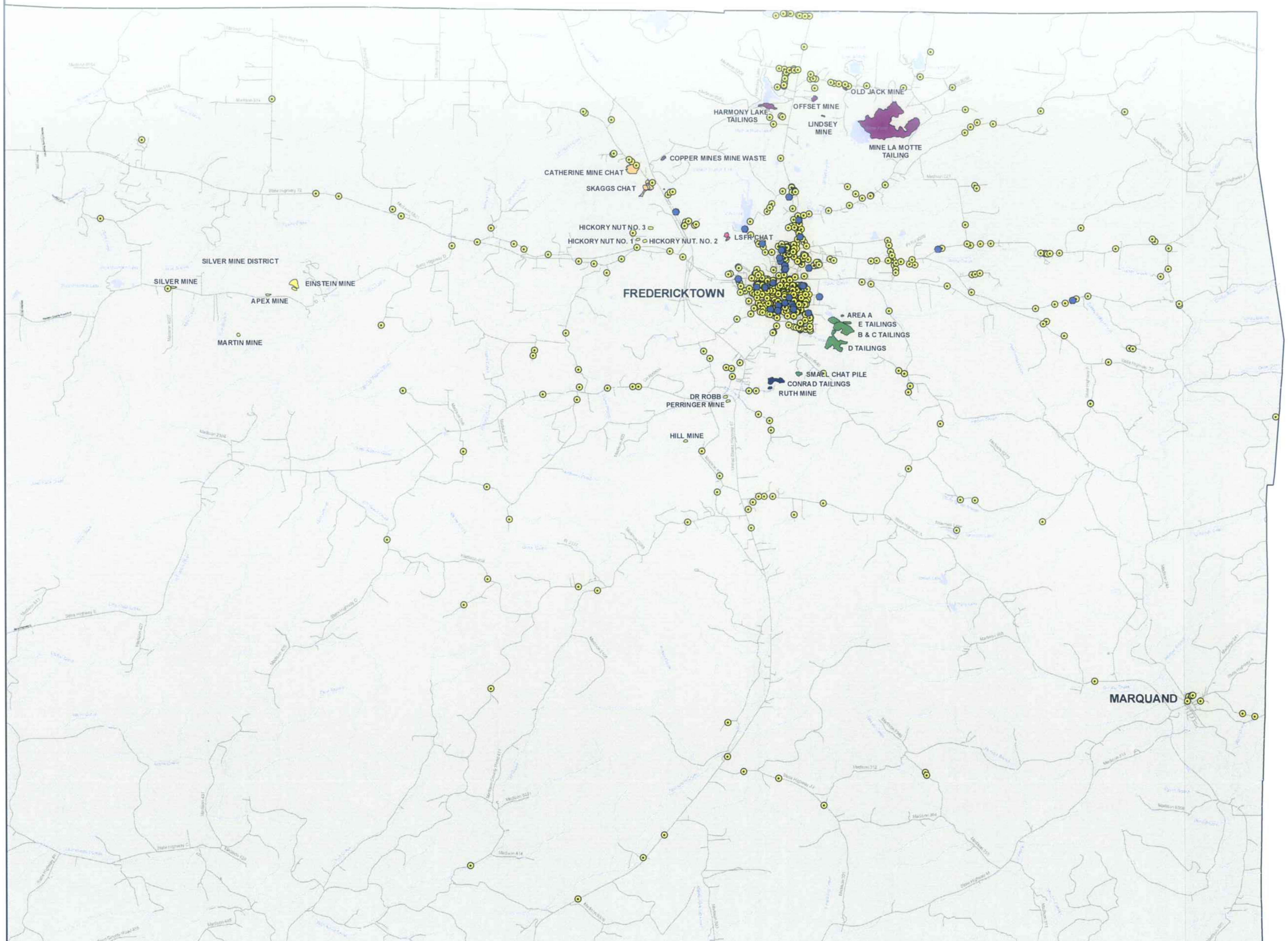
Potentially Impacted Media	Exposure Route	Fredricktown and Surrounding Areas: Commerical Workers	Fredricktown and Surrounding Areas: Residents	Mine Areas: ATV Rider	Area Streams and Ponds: Recreational Visitor (Adult)	Area Streams and Ponds: Recreational Visitor (Child)
Dust in Air (wind disturbance)	Inhalation	X	X	X	X	X
Dust in Air (human disturbance)	Inhalation			●		
Surface Soil	Ingestion	●	●	●	●	●
Surface Soil	Dermal	●	●	●	●	●
Terrestrial Food Items: Vegetables	Ingestion		X			
Subsurface Soil	Ingestion					
Subsurface Soil	Dermal					
Right of Ways/Roads	Ingestion		O			
Right of Ways/Roads	Dermal		O			
Sediment	Ingestion				●	●
Sediment	Dermal				●	●
Aquatic Food Items: Fish	Ingestion				●	●
Surface Water	Ingestion				●	●
Surface Water	Dermal				●	●
Groundwater	Ingestion	●	●			

LEGEND

●	Pathway is complete and might be significant; sufficient data are available for quantitative evaluation
O	Pathway is complete and might be significant; insufficient data are available for quantitative evaluation
X	Pathway is or may be complete, however, risk is low or data are lacking. Qualitative evaluation only.
	Pathway is not complete; no evaluation required

FIGURE 3:
LOCATION OF RESIDENTIAL PROPERTIES WITH LEAD CONCENTRATIONS GREATER THAN 1200 ppm

MADISON COUNTY MINES SITE
FREDERICKTOWN, MISSOURI



BLACK & VEATCH

Special Projects Corp.

Legend

- Residential properties that have not been remediated with lead concentrations between 400 - 1,200 ppm
- Remediated residential properties that had lead concentrations between 400 - 1,200 ppm
- Mine Waste OU1
- Mine Waste OU2
- Mine Waste OU3
- Mine Waste OU4
- Mine Waste OU5
- Mine Waste OU6
- Lakes
- Streams
- Streets

LSFR - Little St. Francis River

N

0 2,500 5,000 10,000 15,000

Feet

FIGURE 4:
LOCATION OF RESIDENTIAL PROPERTIES WITH LEAD CONCENTRATIONS BETWEEN 400 - 1,200 ppm

MADISON COUNTY MINES SITE
FREDERICKTOWN, MISSOURI

Table 1
Quantitative Chemicals of Potential Concern

CHEMICAL	SURFACE SOIL	SEDIMENT	SURFACE WATER	GROUNDWATER	FISH TISSUE
Aluminum	x	x			
Antimony	x	x	x	x	
Arsenic	x	x	x	x	x
Barium	x	x			
Beryllium					
Cadmium	x	x		x	x
Calcium					
Chromium	x	x		x	
Colbalt	x	x	x	x	x
Copper	x	x		x	x
Fluorine	NA	NA	NA	x	
Iron	x	x	x	x	
Lead	x	x	x	x	x
Magnesium					
Manganese	x	x	x	x	
Mercury	x	NA	x	NA	
Molybdenum		NA			
Nickel	x	x	x	x	x
Potassium					
Selenium			x	x	x
Silver	x				
Thallium	x	x	NA		
Tin		NA		NA	
Titanium	NA	NA			
Vanadium	x	x	x		
Zinc	x			x	x

NA = Chemical not analyzed (no data to evaluate)

Table 2

Current Risk to Children from Ingestion of Lead in Surface Soil and Groundwater

Summary of Risks to Child Residents from Exposure to Lead in Surface Soil

ESTIMATED NUMBER AND PERCENT OF PROPERTIES WITHIN THE SPECIFIED P10(%) RANGE					
	≤5%	>5% to ≤10%	>10% to ≤20%	>20% to ≤50%	>50%
# of properties	799	47	32	55	37
% of properties	82%	5%	3%	6%	4%

Notes:
P10 - Probability of exceeding a blood lead value of 10 ug/dL (%)

Summary of Risks to Child Residents from Exposure to Lead in Groundwater

Exposure Unit (Well)	P10 (%)
20011	0%
20008	0%
20001	0%
20003	0%
20004	0%
20005	0%
20006	0%
20007	0%
20009	0%
20010	0%
20012	0%
20018	0%
20020	0%
20021	0%
20022	0%
20023	0%
20024	0%
20025	0%
20027	0%
20028	63%
20030	0%

Exposure Unit (Well)	P10 (%)
20031	0%
20032	0%
20033	0%
20034	0%
20035	0%
20036	0%
20037	0%
20038	0%
20039	0%
20040	0%
20041	0%
20042	0%
20043	0%
20044	10%
20047	0%
20013	0%
20014	0%
20015	0%
20016	0%
20017	0%
20019	0%

Notes: Shading indicates a P10 value (probability of a blood lead level exceding 10 ug/dl) that exceeds 5%

Hatching indicates a P10 value greater than 5%, EPA's health protection goal for children and lead. Upon resampling, these wells yielded results less than the Maximum Contaminant Level for lead. These wells will be evaluated in the future, with a final decision for them made in the final Record of Decision for Operable Unit 3.

The groundwater results represent the total or unfiltered fraction of lead in groundwater.

Table 3
Federal Chemical-Specific ARARs

	Citations	Description
A. ARARs		
1. Safe Drinking Water Act	National Primary Drinking Water Standards 40 C.F.R. Part 141 Subpart B and G	Establish maximum contaminant levels (MCLs), which are health based standards for public waters systems.
2. Safe Drinking Water Act	National Secondary Drinking Water Standards 40 C.F.R. Part 143	Establish secondary maximum contaminant levels (SMCLs) which are non-enforceable guidelines for public water systems to protect the aesthetic quality of the water. SMCLs may be relevant and appropriate if groundwater is used as a source of drinking water.
3. Safe Drinking Water Act	Maximum Contaminant Level Goals (MCLGs) 40 C.F.R. Part 141, Subpart F	Establishes non-enforceable drinking water quality goals. The goals are set to levels that produce no known are anticipated adverse health effects. The MCLGs include an adequate margin of safety.
4. Clean Water Act	Water Quality Criteria 40 C.F.R. Part 131 Water Quality Standards	Establishes non-enforceable standards to protect aquatic life. May be relevant and appropriate to surface water discharges, or may be a TBC.
5. Clean Air Act	National Primary and Secondary Ambient Air Quality Standards 40 C.F.R. Part 50	Establishes standards for ambient air quality to protect public health and welfare.
B. To Be Considered		
1. EPA Revised Interim Soil-lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities and 1998 Clarification	Office of Solid Waste and Emergency Response (OSWER) Directive 9355.4-12, July 14, 1994, OSWER Directive 9200.4-27P, August 1988	Establishes screening levels for lead in soil for residential land use, describes development of site-specific preliminary remediation goals, and describes a plan for soil-lead cleanup at CERCLA sites. This guidance recommends using the EPA Integrated Exposure Uptake Biokinetic Model (IEUBK) on a site-specific basis to assist in developing cleanup goals.
2. EPA Strategy for Reducing Lead Exposures	EPA, February 21, 1991	Presents a strategy to reduce lead exposure, particularly to young children. The strategy was developed to reduce lead exposure to the greatest extent possible. Goals of the strategy are to 1) significantly reduce the incidence above 10 µg Pb/dL in children; and 2) reduce the amount of lead introduced into the environment.
3. Human Health Risk Assessment Report (HHRA)	"Area-Wide Human Health Risk Assessment for the Madison County Mines Site, Madison County, Missouri" – prepared by Syracuse Research Corp., July 2007	Evaluates baseline health risk due to current site exposures and established contaminant levels in environmental media at the site for the protection of public health. The risk assessment approach using this data should be used in determining cleanup levels because ARARs are not available for contaminants in soils.
4. Superfund Lead-Contaminated Residential Sites Handbook	EPA OSWER 9285.7-50, August 2003.	Handbook developed by EPA to promote a nationally consistent decision making process for assessing and managing risks associated with lead contaminated residential sites across the country.
5. Preliminary Remediation Goals	Preliminary Remediation Goals for Lead in Soil at the Madison County Mines, Operable Unit 3 Site, Madison County, Missouri, January 31, 2008.	Establishes preliminary remediation goals for protection of residents from lead in surface soil at the Madison County Mines Site, Operable Unit 3.

Table 4
State Chemical-Specific ARARs

	Citation	Description
A. ARARs		
1. Missouri Air Conservation Law	Missouri Department of Natural Resources RSMo 643.010 10 CSR 10-6.010	Sets ambient air quality standards for a variety of constituents, including particulate matter and lead. Provides long range goals for ambient air quality throughout Missouri in order to protect the public health and welfare.
2. Hazardous Waste Management Law	Missouri Department of Natural Resources Identification and Listing of Hazardous Waste 10 CSR 25-4.261 (A) 1, 2, 4	Defines those solid wastes which are subject to regulations as hazardous wasters under 10 CSR 25.
3. Missouri Clean Water Law	Missouri Department of Natual Resources RSMo 644.006 10 CSR 20-7.015 (1) (2) (3) (4) (5) (6) (7) (9)	Sets forth the limits for various pollutants which are discharged to the various waters of the state. Sets effluent standards that will protect receiving streams.
4. Missouri Clean Water Law	Missouri Department of Natural Resources RSMo 644.006 10 CSR 20 – 7.031 (2) (3) (4) (5); Tables (A) (B)	Identifies beneficial uses of waters of the State, criteria to protect their uses, and defines the antidegradation policy.
B. To Be Considered	None	

Table 5
Federal Location-Specific ARARs

	Citation	Description
A. ARARs		
1. Historic project owned or controlled by a federal agency	National Historic Preservation Act: 16 U.S.C. 470, et.seq; 40 C.F.R. § 6.301; 36 C.F.R. Part 1.	Property within areas of the Site is included in or eligible for the National Register of Historic Places. The remedial alternatives will be designed to minimize the effect on historic landmarks.
2. Site within an area where action may cause irreparable harm, loss, or destruction of artifacts.	Archeological and Historic Preservation Act; 16 U.S.C. 469, 40 C.F.R. 6.301.	Property within areas of the site may contain historical and archaeological data. The remedial alternative will be designed to minimize the effect on historical and archeological data.
3. Site located in area of critical habitat upon which endangered or threatened species depend.	Endangered Species Act of 1973, 16 U.S.C. 1531-1543; 50 C.F.R. Parts 17; 40 C.F.R. 6.302. Federal Migratory Bird Act; 16 U.S.C. 703-712.	Determination of the presence of endangered or threatened species. The remedial alternatives will be designed to conserve endangered or threatened species and their habitat, including consultation with the Department of Interior if such areas are affected.
4. Site located within a floodplain soil.	Protection of Floodplains, Executive Order 11988; 40 C.F.R. Part 6.302, Appendix A.	Remedial action may take place within a 100-year floodplain. The remedial action will be designed to avoid adversely impacting the floodplain in and around the soil repository to ensure that the action planning and budget reflects consideration of the flood hazards and floodplain management.
5. Wetlands located in and around the soil repository.	Protection of Wetlands; Executive Order 11990; 40 C.F.R. Part 6, Appendix A.	Remedial actions may affect wetlands. The remedial action will be designed to avoid adversely impacting wetlands wherever possible including minimizing wetlands destruction and preserving wetland values.
6. Waters in and around the soil repository.	Clean Water Act, (Section 404 Permits) Dredge or Fill Substantive Requirements, 33 U.S.C. Parts 1251-1376; 40 C.F.R. Parts 230, 231.	Capping, dike stabilization, construction of berms and levees, and disposal of contaminated soil, waste material or dredged material are examples of activities that may involve a discharge of dredge or fill material. Four conditions must be satisfied before dredge and fill is an allowable alternative: 1. There must not be a practical alternative. 2. Discharge of dredged or fill material must not cause a violation of State water quality standards, violate applicable toxic effluent standards, jeopardize threatened or endangered species or injure a marine sanctuary. 3. No discharge shall be permitted that will cause or contribute to significant degradation of the water. 4. Appropriate steps to minimize adverse effects must be taken. Determine long- and short-term effects on physical, chemical, and biological components of the aquatic ecosystem.

Table 5 (Continued)
Federal Location-Specific ARARs

A. ARARs (Continued)	Citation	Description
7. Area containing fish and wildlife habitat in and around the removal repository.	Fish and Wildlife Conservation Act of 1980, 16 U.S.C. Part 2901 et seq.; 50 C.F.R. Part 83.9 and 16 U.S.C. Part 661, et seq. Federal Migratory Bird Act, 16 U.S.C. Part 703.	Activity affecting wildlife and non-game fish. Remedial action will conserve and promote conservation of non-game fish and wildlife and their habitats.
8. Fish and Wildlife Coordination Act	16 U.S.C Section 661 et seq.; 33 C.F.R Parts 320-330; 40 C.F.R 6.302	Requires consultation when a Federal department or agency proposes or authorizes any modification of any stream or other water body, and adequate provision for protection of fish and wildlife resources.
9. 100-year floodplain	Location Standard for Hazardous Waste Facilities- RCRA; 42 U.S.C. 6901; 40 C.F.R. 264.18(b).	RCRA hazardous waste treatment and disposal. Facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout during any 100-year/24 hour flood.
10. Historic Site, Buildings, and Antiquities Act	16 USC Section 470 et seq., 40 CFR Sect. 6.301(a), and 36 CRF, Part1.	Requires Federal agencies to consider the existence and location of landmarks on the National Registry of Natural Landmarks and to avoid undesirable impacts on such landmarks.
11. Clean Air Act	National Ambient Air Quality Standards/ NESHAPS 42 U.S.C. 74112; 40 C.F.R. 50.6 and 50.12	Emissions standards for particular matter and lead.
B. To Be Considered	None	

Table 6
State Location-Specific ARARs

	Citation	Description
A. ARARs	None	
B. To Be Considered	None	

Table 7
Federal Action-Specific ARARs

	Citation	Description
A. ARARs		
1. Disposal of Solid Waste in the Permanent Repository and closure of the Removal Repository.	Subtitle D of RCRA, Section 1008, Section 4001, et seq., 42 U.S.C. '6941, et seq.	State or Regional Solid Waste Plans and implementing federal and state regulations to control disposal of solid waste. The yard soils disposed in the repository may not exhibit the toxicity characteristic and therefore, are not hazardous waste. However, these soils may be solid waste. Soils failing TCLP were contaminated by mining wastes so all wastes are exempt from definition of hazardous waste per the Bevill exemption. Contaminated residential soils will be consolidated from yards throughout the site into a few repositories. The disposal of this waste material should be in accordance with regulated solid waste management practices.
2. Clean Water Act	Water Quality Criteria 40 C.F.R. part 131 Water Quality Standards	Establishes non-enforceable standards to protect aquatic life.
3. Clean Air Act	National Ambient Air Quality Standards/ NESHAPS 42 U.S.C. 74112; 40 C.F.R. 50.6 and 50.12	Emissions standards for particular matter and lead.
4. Hazardous Materials Transportation Act	Hazardous Materials Transportation Regulations 49 C.F.R. parts 107, 171-177	Regulates transportation of hazardous materials.
5. NPDES Storm Water Discharge for Permanent Repository.	40 C.F.R. Part 122.26: 33 U.S.C 402 (p)	Establishes discharge regulations for storm water. Required management of repository where waste materials come into contact with storm water. Also required during construction of the repository.
6. Transportation of excavated soils.	DOT Hazardous Material Transportation Regulations, 49 C.F.R. parts 107, 171-177	Regulates transportation of hazardous wastes.
7. Waters in and around the soil repository.	Clean Water Act, (Section 404 Permits) Dredge or Fill Substantive Requirements, 33 U.S.C. parts 1251-1376; 40 C.F.R. parts 230,231.	Capping, dike stabilization, construction of berms and levees, and disposal of contaminated soil, waste material or dredged material are examples of activities that may involve a discharge of dredge or fill material. Four conditions must be satisfied before dredge and fill is an allowable alternative: 1. There must not be a practical alternative. 2. Discharge of dredged or fill material must not cause a violation of State water quality standards, violate applicable toxic effluent standards, jeopardize threatened or endangered species or injure a marine sanctuary. 3. No discharge shall be permitted that will cause or contribute to significant degradation of the water. 4. Appropriate steps to minimize adverse effects must be taken. Determine long- and short-term effects on physical, chemical, and biological components of the aquatic ecosystem.
8. Occupational Safety and Health Standards	29 C.F.R. 1910	Establishes worker safetymeasures.
B. To Be Considered	None	

Table 8
State Action-Specific ARARs

A. ARARs	Citation	Description
1. Missouri Fugitive Particulate Matter Regulations	Missouri Department of Natural Resources 10 CSR 10-6.170	The Missouri fugitive particulate matter regulations contain restrictions on the release of particulate matter to ambient air. These regulations are applicable to any dust emissions that occur as a result of remedial actions taken at the site.
2. Missouri Clean Water Law – Storm Water Regulations	Missouri Department of Natural Resources 10 CSR 20-6.200	These regulations define Best Management Practices for land disturbances, including practices or procedures that would reduce the amount of metals in soils and sediments available for transport to waters of the state. Permits would not be required for actions taken under CERCLA, but the substantive provisions of these regulations would be applicable. The Missouri standards would be considered ARARs only if they are more stringent than the Federal standards. Requires permits for metal and non-metal mining facilities and land uses or disturbances that create point source discharges of storm water.
3. Missouri Hazardous Substances Emergency Response	Missouri Department of Natural Resources RSMo 260.520 10 CSR 24-3.010	Establishes a statewide emergency telephone number to notify the State whenever a hazardous substance emergency occurs and specifies the requirements for emergency notification and follow up written notice.
4. Missouri Solid Waste Disposal Law	Missouri Department of Natural Resources RSMo 260.225 10 CSR 80-5.010 (2)	Contains requirements for determining what solid wastes will be accepted at landfills and identifying any special handling requirements.
5. Missouri Solid Waste Disposal Law	Missouri Department of Natural Resources RSMo 260.225 10 CSR 80-5.010 (5) (A), (B) 1-4, (C)	Requires all waters discharged from solid waste processing facilities to be sufficiently treated to meet applicable water quality standards, including those established under the authority of the Federal Water Pollution Control Act.
6. Missouri Hazardous Waste Management Law	Missouri Department of Natural Resources RSMo 260.370 10 CSR 25-5.262	Sets forth standards for generators of hazardous waste, incorporates 40 CFR Part 262 by reference, and sets forth additional state standards.
7. Missouri Hazardous Waste Management Law	Missouri Department of Natural Resources RSMo 260.385 and 260.395 10 CSR 25-6.263	Sets forth standards for transporters of hazardous waste, incorporates 40 CRF Part 263 and certain regulations in 49 CFR by reference, and sets forth additional state standards.
8. Missouri Hazardous Waste Management Law	Missouri Department of Natural Resources RSMo 260.370, 260.390, and 260.395 10 CSR 25-7.264(2)(A) through (2)(G), (2)(K) through (2)(N), and/or (2)(S)	Sets forth the standards for owners and operators of hazardous waste treatment, storage and disposal facilities; incorporates and modifies the federal regulations in 40 CFR Part 264 by reference, and sets forth additional state requirements.
9. Missouri Hazardous Waste Management Law	Missouri Department of Natural Resources RSMo 260.370, 260.390, 260.395, and 260.400 10 CSR 25-7.268	Establishes standards and requirements that identify hazardous wastes that are restricted from land disposal.
B. To Be Considered	None	

Table 9 - Selected Remedy (Alternative 2) Cost Estimate
Present Worth Cost Estimate - Excavation, Disposal, Vegetative Cover, and Institutional Controls

Cost Estimate Component	Quantity	Units	Unit Cost	Capital Cost
Capital Costs				
Mobilization [(1)]	1		$50,000	$50,000
Property Access, Contaminant Assessment [(1)]	1,100	Properties	$400	$440,000
Sample Property	748	Properties	$600	$448,800
Material Movement (excavation, transport, backfilll, dust suppression)	204,600	yd^3	$63	$12,889,800
Post Cleanup Reports [(1)]	1,100	Properties	$100	$110,000
Vegetative Cover [(2)]	1,100	Properties	$2,000	$2,200,000
Lead Stabilization	715	Tons SulfiTech	$225	$160,875
10 yd^3 mixer to mix soil and SulfiTech A/T (rental and labor)	24	months	$1,300	$31,200
Air Monitoring (sample and pump rental costs)	15	Samples	$88	$1,320
Road Evaluation (1yd^2 is 3-inches thick)	20,000	yd^2	$10	$200,000
Under Sink Water Filter	2	Filter	$160	$320
Repository Maintenance Cost	1,433	yd^3	$5	$7,308
DIRECT CAPITAL COST SUBTOTAL				$16,539,623
Bid Contingency (15%)				$2,480,900
Scope Contingency (10%)				$1,654,000
TOTAL DIRECT CAPITAL COST				$20,674,523
Pemitting and Legal (2%)				$413,500
Construction Services (10%)				$2,067,500
CONSTRUCTION COST TOTAL				$23,155,523
Engineering Design (3%)				$694,700
NON-RECURRING CAPITAL COST				$23,851,000

OTHER ANNUAL COSTS				
Governmental Controls Pilot Project	1	year	$80,000	$80,000
Institutional Controls (Annual Health Education)	4	year	$125,000	$500,000
Allowance for Repository Maintenance Cost	4	year	$2,000	$8,000
Under Sink Water Filter Replacement	3	units per year	$148	$1,332

Present Worth Analysis

Year	Annual Capital Costs	Costs Include:
1	$6,169,900	Annual Capital Costs are assumed to be 25% of the Total Capital Cost.
2	$6,090,100	Annual Capital Costs are assumed to be 25% of the Total Capital Cost.
3	$6,090,000	Annual Capital Costs are assumed to be 25% of the Total Capital Cost.
4	$6,090,000	Annual Capital Costs are assumed to be 25% of the Total Capital Cost.
Total Capital Costs	**$24,440,000**	
Total Present Worth of Capital Costs	**$22,446,000**	

Cost Estimate Component	Capital Cost
TOTAL PRESENT WORTH	**$22,446,000**

Notes:

1 - Information from Feasibility Study for Residential Yard Soil, Omaha Lead Site, Omaha, Nebraska, EPA, 2004

2 - Information from Evaluation of Phosphate Treatment of Residential Properties; Omaha Lead Site, Omaha, Nebraska, Black and Veatch, 2007

3 - A 3.5% discount rate was used to calculate present worth.

4 - The bid contingency for the project was estimated to be 15% of the direct capital cost subtotal.

5 - The scope contingency for the project was estimated to be 10% of the direct capital cost subtotal.

6 - Permitting and legal fees for the project were estimated to be 2% of the total direct cost.

7 - The construction services cost for the project was estimated to be 10% of the total direct cost.

8 - The engineering design cost for the project was estimated to be 3% of the total direct cost.